

A review paper on Autonomous Robotic Vacuum Cleaner

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ABSTRACT

Vacuum cleaner robot is a kind of dirt removal system. It is a machine which will automatically clean. A vacuum cleaner robot uses robot system which will make many decisions itself with the help of sensors. System is made up of multiple sensors which will collect data, send to the robot's microcontroller and change directions accordingly. It has an easy to empty reusable dustbin. It uses IR sensors to detect obstacles. It is programmed to accept inputs from sensors to sense obstacles around it and control the robot to avoid any collisions. In case of an obstacle, the microcontroller controls the wheel movement of the robot by a motor driver to avoid collision and prevent the robot from colliding with the object in front. The vacuum cleaner of the robot performs the cleaning operation.

Keywords

IR Sensor, Ultrasonic Sensor, PMDC motor, Servo motor, ARM controller, LCD, Battery.

1. INTRODUCTION

In this present era, people live a very busy life. People in cities have irregular and long working times. In such a situation a person will always try to find a way of saving time and cleaning tops the list. It is not only time consuming, but also very tiring. Especially for busy people it becomes difficult to maintain their surrounding areas around their residence as they have to handle both home and office work together. In this busy life, we thought of gifting people and corporations a way of saving some of their precious time, man power, money e.t.c.. The requirement of a Cleaning Robot is born for saving time and man power we needed an automatic system that cleans on its own without or less supervision. And also we did think about how to aid people with physical disabilities, thus helping a physically disabled person.

The advent of new high technology and growing computer capacity provided realistic opportunity for new robot controls and the realization of new methods of control theory. This technical improvement together with the need of high performance robots created faster, more accurate and more intelligent robots using new robots control device new drives and advanced control algorithms.

This is an Autonomous Robotic Vacuum Cleaner based on an ARM cortex M3 (STM32F103CBT6). In this robot we are using IR sensor, Ultra sonic sensor, PMDC motor, Servo Motor. It is mainly used to clean the area through the vacuum suction. The sensors are used to detect obstacles and the motors will guide it in proper direction and the vacuum suction will clean the garbage coming in its way. The ARM controller is used to control the motor movement. It gets the signals from the IR/Ultrasonic sensors and it drives the motors according to the input provided from the sensors output. Two PMDC motors are used to drive the robot and servomotor is used to change direction.

1.1 Overview

We have designed a autonomous robot, does work by itself. In designing of this robot we have used different sensors and motors. All the controlling is done through ARM controller and mechanisms are done simultaneously. Bumper switches are used for the safety and LCD for user interface.

1.2 Technical Specifications

- Drive: PMDC works on 12V, and servomotor on 5V.
- Lead Acid battery 7 A/hr. 12 volts
- Ultra Sonic sensor range is 4m Max & 2cm Min and operates on 5v and 50Hz freq.
- 16x2 LCD for interfacing.

2. BLOCK DIAGRAM

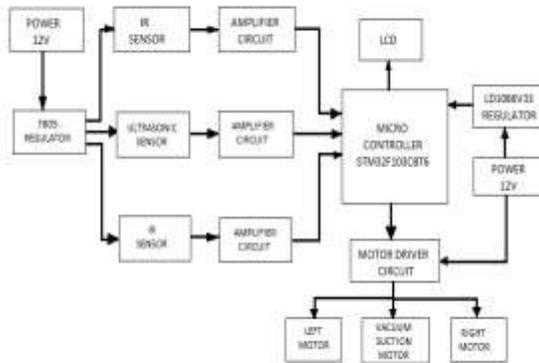


Fig 1: BLOCK DIAGRAM

In this we have used Arm controller STM32F103CBT6. IR and Ultra Sonic sensors are used for avoiding obstacles and used sensor's data for path planning and navigation. Rechargeable lead acid battery is used as the power supply. LCD is used for the user interface and it displays a welcome screen. Vacuum suction is mounted below for the cleaning operation. The two PMDC motors are controlled by controller through motor driver circuit. Bumper switches are used at the edges of the robot for the protection.

3. HARDWARE ASPECTS

Sensors

In this system we are using IR sensor i.e. attached at the front end of the chassis used for avoiding obstacles and ultrasonic sensor i.e. attached at the front top of the chassis just above the motor i.e used for path planning and navigation.

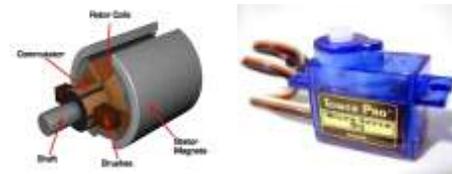


IRSENSORULTRASONIC SENSOR

Motors

In this system we are using PMDC motor i.e. attached with the wheels used to drive the robot. Servomotor i.e. attached

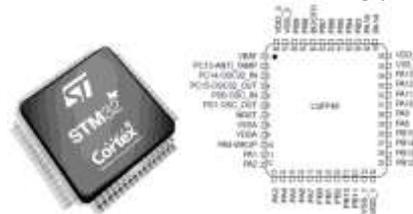
at the front top of the chassis used to change direction of the ultrasonic sensor.



PMDC MOTOR SERVO MOTOR

Arm Controller

In this system the data collected by different sensors are send to the Arm cortex M3(STM32F103CBT6)where the controller interpret the data and change the direction of the robot accordingly.



PIN DIAGRAM

16x2 LCD

16x2 LCD screen is an electronic display module usedfor user interface and it displays welcome screen.



Vacuum Cleaner

It is a device used for cleaning operation that suck up the dirt and dust.



Rechargeable lead acid battery

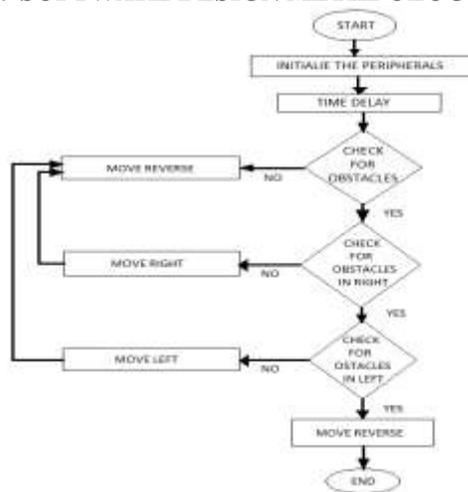
It is used to give power supply to the system i.e. 12V, 7A/hr.

**4. WORKING**

Microcontroller is the main control unit of the entire system, program is coded into it. It controls switching of components. Microcontroller takes data from the sensors and gives response accordingly. Initially, system is in a inactive state, start button is pressed for the initialization of all the peripherals and after initialization system moves forward. As an obstacle come in front of the robot, sensors detect the obstacles and gives the data to the controller. Once the controller processes these data, it gives response to the motor for right or left movement.

PMDC motors are used for the movement of the robot. Motors are connected to a motor driver and then controlled by a controller.

The blower is mount below the frame is used for suction of dust and dirt also gets started as soon as controller initializes the peripherals. The Ultrasonic sensor and IR sensors are used for obstacle detection. When the Ultrasonic sensor detects an obstacle in front of it, then it moves to right and check for further obstacle. If there is no obstacle in right, then it sends data to controller and the controller gives response to the motor to rotate right. If there is obstacle in right, then it check for left and follow the same step as explained above. The IR sensor that is attached at the bottom of the frame is used as a staircase sensor to avoid pit.

5. SOFTWARE DESIGN METHODOLOGY**5. RESULT**

By using this robot working people, old people and physically challenged people can easily clean their indoor and outdoor premises without any consumption of time and effort.

6. CONCLUSION

In conclusion we would say that this robot is of great use to the society and it satisfies all the conditions of being of no harm. This robot will do all the desired features with good efficiency. The application of this robot is: house, café, school, college, office, clinic etc. With the advancement in technology this will definitely prove to be immense important. There is great future scope of this robot and also in this type of application.

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