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Short Communication

Design and Fabrication of Robotic Vacuum Cleaner with Blower Unit

Shanawaz Patil*

School of Mechanical Engineering, REVA University, India

***Corresponding author:** Shanawaz Patil, School of Mechanical Engineering, REVA University, India

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Abstract

Hygiene is the most important factor for a clean and healthy lifestyle. A clean surrounding contributes a greater aspect for a good health. So, it is necessary to keep the surroundings neat and clean. There are many types of equipment which reduces the efforts of humans in cleaning. Here comes the scope of the floor cleaning and drying equipment for household purposes. This project is to design and fabricate such a machine at an easy affordable price for usage in at every house. The floor cleaning device which we have designed is more compact and smaller in size than the usual model you see in the market. This floor cleaner comes with a vacuum cleaner in the front and a hot air blower at the rear end.

Keywords: Mechatronics; Floor cleaning; Vacuum cleaning; Hot air blower

Introduction

Hygiene is the most important factor for a clean and healthy lifestyle. A clean surrounding contributes a greater aspect for a good health. So, it is necessary to keep the surroundings neat and clean. If you see it on a practical level, it can be said that cleanliness is related to hygiene and disease prevention. Household cleaning is a repetitive task carried out by a few people day by day. Hence there should be a bringing revolution in the field of science and technology which could help easily in repetitive tasks which we perform daily. And considering the intensity of labor that is required as well as improving the qualities to its optimum level.

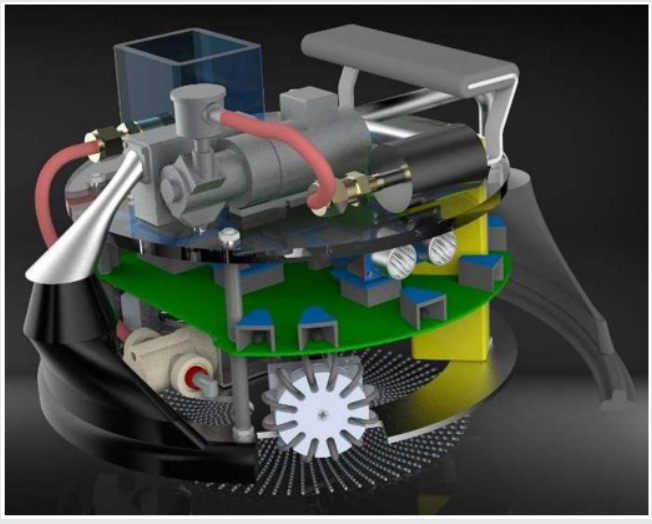

Figure 1: Isometric View of the Robot.

There are many types of equipment which reduces the efforts of humans in cleaning. There are already several big bulky floor cleaning machines that are widely available at the market which is incapable of cleaning the remote areas which are out of reach Figure 1.

There are machines that can clean and machines that can dry but a machine which performs both functions is rare. Here comes the scope of the floor cleaning and drying equipment for household purposes. This project is to design and fabricate such a machine at an easy affordable price for usage in at every house. The floor cleaning device which we have designed is more compact and smaller in size than the usual model you see in the market. This floor cleaner comes with a vacuum cleaner in the front and a hot air blower at the rear end. The bottom part consists of a rotating mopping scrubber to clean detergent wet floor. The objective of this project is to design and fabricate a robotic vacuum cleaner with sweeper and blower unit which can save time in carrying out the cleaning process that too with optimum cost as well as minimum power consumption.

Aesthetics

The model developed by us consisted of base stainless-steel plate and the above layer consisted of transparent glass the nozzles were made of plastic. The size of this robot was 30x30x50cm (LxBxH). The future robot for the consumer purpose can be made using a plastics or aluminum alloy

Design of the Robot and Working

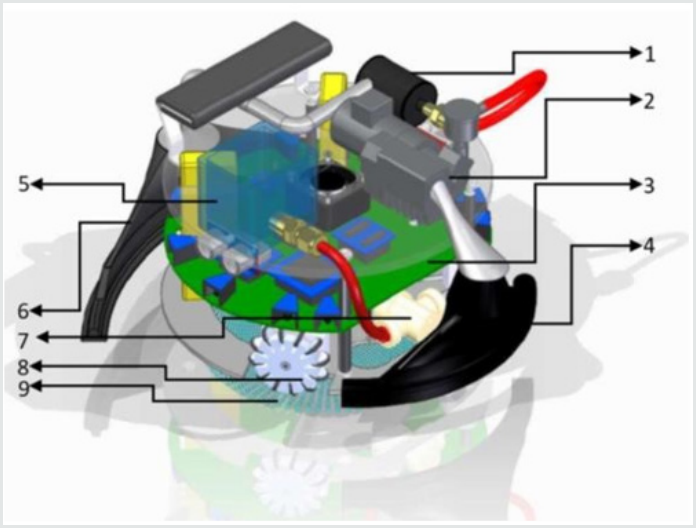

Figure 2: Detailed Parts.

A 3-D model of the product with accurate dimensions and tolerances was drafted using solid works software and the analysis was done for various stresses that could act on it and calculations were made in order to select the desirable capacity of the motor required for the smooth functioning of the device. Optimization of the product focuses delivering of an ergonomic, comparatively cheap and efficient cleaner and drier to the customer. The power drive for the scrubber is selected to be electric and to be driven by a single dc motor. Considerations for the storage and easy handlings are taken care. The cleaning brush is selected to be of industrial grade. The blower unit is also selected in such a way that power consumption was reduced as much as possible while keeping the machine in efficient working condition Figure 2.

The main parts highlighted in Figure 2 are

1. Heating coil
2. Suction pump
3. Control board
4. Suction nozzle
5. Water container
6. Blower nozzle
7. 2/2 normally open Solenoidal valve
8. omni wheels
9. Scrubber

PCB Layer

The PCB Layer consist of the ATMEGA 2560 Microprocessor which controls the robot, it consists of Sharp-IR sensors and ultrasonic sensors placed at different angles so that the robot can detect objects near it. The suction pump creates vacuum and sucks in the dirt. The air is then cleaned using filter and then passed to the heater coil where the air is heated up and then passed to the blower nozzle Figure 3.

The robot is powered by two powerful lithium-ion battery which can easily be recharged. For the sprinkling of water, solenoid valve is used Figure 4.

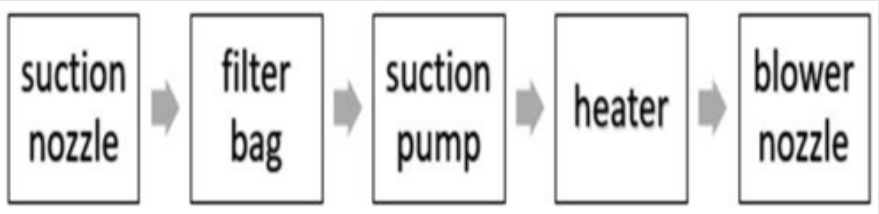

Figure 3: Block Diagram of the Cleaning and Blower Unit.

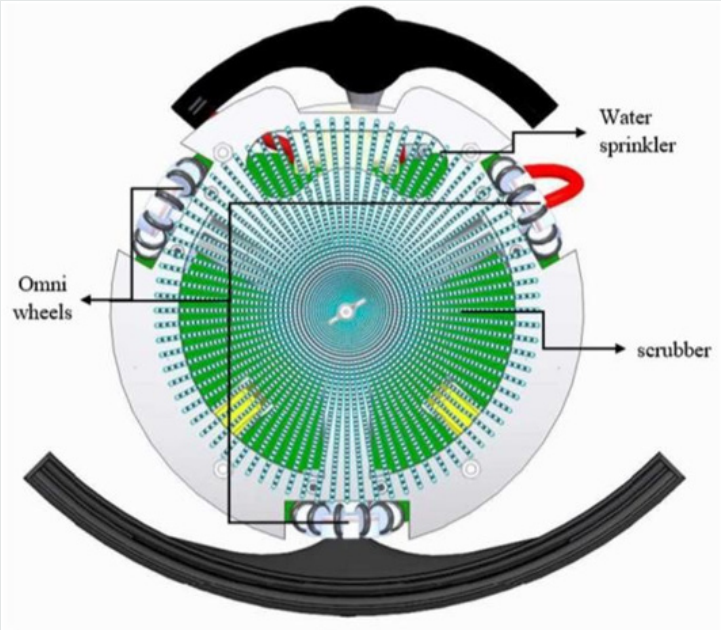

Figure 4: Detailed Bottom View.

Water Sprinkling System

The water sprinkling system of this robot consist of a water tank placed at higher level and a 2/2 solenoidal valve. As the tank is placed at the higher level the water flows due to gravity and potential energy. The valve is electrically actuated with the help of a RELAY which is controlled by the ATMEGA 2560 microprocessor Figure 5.

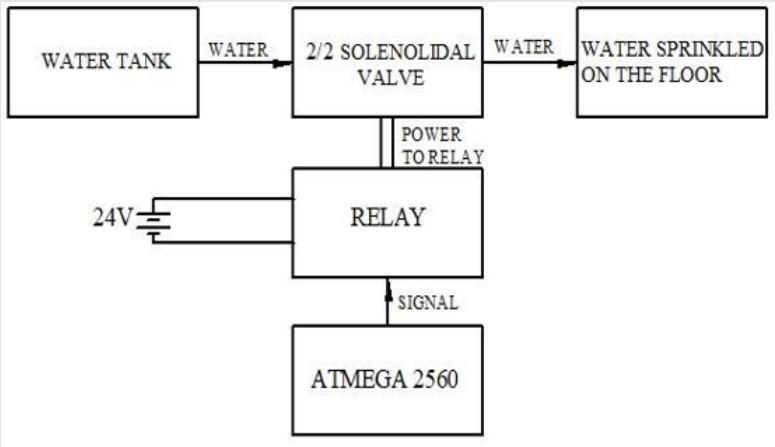

Figure 5: Water Sprinkling System.

Air Heating Process

Here the air sucked from the suction nozzle by suction pump is passed to the heating coil where the air is heated using a resistive coil and is then passed to the blower nozzle Figure 6.

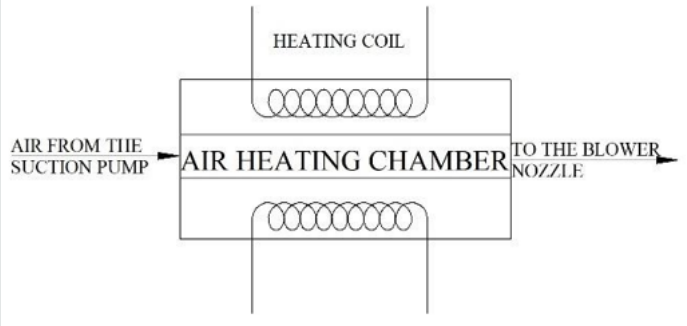

Figure 6: Air Heating System.

Advantages of the Robot

1. It is completely autonomous
2. It has both vacuum cleaning and blower unit.
3. It has a water sprinkler to moisturize the floor for better cleaning
4. It requires less power as it uses single suction pump for both
5. Blower and vacuuming unit
6. It is light weight and flexible to use

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