

Design and Development of Multi-functional Floor Cleaning Machine

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Abstract: This project's aim is to clean floors in schools, hospitals, auditoriums, shopping malls, and workshops. The aim of this project is to design and improve a cleaning process for a floor with wet and dry surfaces. The cleaning of floors was traditionally performed by 8 to 10 employees, which resulted in significant exhaustion among the workers as well as a lack of cleaning quality. It has a very simple construction and is simple to operate; anyone can operate it. This floor cleaning machine includes a moisture cotton mop, swiping brushes, and wipers cleaner to cut cleaning time in half.

Key Words: DC geared motor, fasteners, switch board, water tank, caster wheels, frame, vacuum cleaner, heating coil, mop, wiper, brush or scrubber and chassis.

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I. Introduction

With the help of a variety of equipment, floor cleaning has become very simple in today's world. A floor cleaning machine is a machine that cleans floors more easily and quickly than traditional cleaning methods. It's also used to cut down on human effort and time. This project's goal is to clean floors in industries, colleges, hospitals, auditoriums, malls, and workshops, among other places. The goal of this project is to design and develop a cleaning process for floors with wet and dry surfaces. The traditional method of cleaning floors with a large number of workers resulted in significant fatigue among the workers, as well as a lack of cleaning efficiency. Anyone can handle this project with ease, and no prior experience is required. It can be easily moved from one location to another. In addition, elderly people can use it to clean without feeling strained. A Multi-purpose Floor Cleaning Machine is created in this project, with some basic considerations such as energy consumption, cost reduction, environmental friendliness, and ease of use.

II. Literature Review

After reviewing various floor cleaning machine research papers, we've come to the conclusion that there are some limitations to floor cleaning machines that can be addressed. Cleaning machines, for instance, are designed to clean only the floor's dry surface. This means that they are only adequate during the summer and winter seasons, but not during the rainy season. This is a major issue for cleaning the floor surface, but during the rainy season, floor cleaning machines are required to perform tasks when the floor surface contains moisture or a small amount of water. As a result, we're working on a machine that can work in both dry and wet environments. This machine is also known as a dry and wet floor cleaner. In the summer, this machine can remove dust, and in the rainy season, it can remove and clean dirt and water from the floor [1].

The development of a multi-purpose floor cleaning machine capable of vacuuming, mopping, and heating is described. Furthermore, in some cases, the robot will need to run through the floor multiple times to ensure complete cleaning. This paper tries to make the most of the floor cleaning machine's capabilities [2].

We've discovered that the majority of people clean their floors by hand. This will necessitate more people and time. Furthermore, the cost of cleaning machines on the market is exorbitant. In this study, we pay special attention to the model's time and cost reduction [3].

During a power outage, a manually operated floor cleaning machine can be used instead of an automated floor cleaning machine. The equipment was created specifically for cleaning floors, but it can only be used outdoors in areas with a lot of space, such as hospitals, bus stops, railway stations, industries, and schools. When compared to other existing floor cleaning machines, the equipment will be more beneficial. Our project is to create a floor cleaning machine that can perform all cleaning tasks (mopping, collecting dirt and heating wet surface). Any malfunction in this machine can be quickly identified and corrected [4].

We learn in this paper that cleanliness is critical in enhancing the ambiance of any workplace, including malls, offices, and industries. However, maintaining a clean environment necessitates arduous labour and a large workforce. Various industries and manufacturing firms are also incorporating 5S methodologies into their daily operations.

Maintaining a clean and tidy workplace environment is the first step in 5S implementation. To accomplish this, more manpower is required, and it takes time. As a result, a multi-functional floor scrubber and cleaner must be designed and developed. The project's main goal is to create a machine that is much more cost-effective than those currently on the market while also cleaning any type of floor effectively. Before beginning the development of the machine, we researched existing machines on the market. We came to the conclusion from the study that there are four important principles to follow for effective cleaning: time, agitation, chemical, and temperature. Everyone will be able to achieve the best cleaning results if they follow these guidelines[5].

III. Component

The components of floor cleaning machine are as follows

- DC geared motor
- fasteners, switch board
- water tank
- caster wheels
- frame
- vacuum cleaner
- heating coil
- mop
- wiper
- brush or scrubber
- Chassis.

3.1 Dc motor

A DC motor is an electrical machine that generates mechanical power from electric power. Normally, the motor output is a shaft rotational motion. The input can be either a direct current or an alternating current supply. In the case of a DC motor, however, direct current is used. A bar wound with wire is placed between two magnets with North and South poles in a dc motor's mechanism. When the wire is supplied with electricity, it becomes energised, causing rotational motion and thus rotational output. The universal motor is a lightweight motor that can run on direct current and is used in portable power tools and appliances. With the advent of power electronics, it is now possible to replace DC motors with AC motors in a variety of applications. A lightweight motor, on the other hand, is ideal for portable power tools and appliances.

3.2 Vacuum cleaner

A vacuum cleaner, also known as a sweeper or Hoover, is a device that sucks up dust and dirt from floors by creating a partial vacuum with an air pump (a centrifugal fan in all but the earliest models). A dust bag or a cyclone collects the dirt to be disposed of later. Vacuum cleaners come in a variety of sizes and models, including small battery-powered hand-held devices, wheeled canister models for home use, domestic central vacuum cleaners, and massive stationary industrial appliances that can handle hundreds of litres of dust before being emptied and self-propelled vacuum trucks for removing contaminated soil or recovering large spills. Dust and liquids can be sucked up with specialised shop vacuums.

3.3 Brush / scrubber

Scrubbers are large brushes with a long shaft that are used to clean hard floors or surfaces. A scrubber, unlike a broom, has hard bristles for brushing rather than soft bristles for sweeping dirt away. As a result, it can be used wet, with either water or cleaning fluids. A removable floor cloth or mop, either soaked in water for cleaning or dry for wiping dry, may be placed around the brush head. Other cleaning implements, on the other hand, are increasingly being used for these and other cleaning tasks. It is one of the most basic and versatile tools in use today, with dozens of different varieties in the average household. They usually consist of a handle or block to which filaments are attached in either a parallel or perpendicular manner, depending on how the brush will be held during use. Both the block and the bristles or filaments are made of materials that can withstand the hazards of the application, such as corrosive chemicals, heat, and abrasion. The common type of brush used is shown in (Fig 1).



Fig 1 Brush / Scrubber

3.4 Wiper

Plastic and sponge are used to make the wiper. The pipe is constructed of zinc-coated aluminium. In the machine, a wiper is provided at the end to clean any remaining dust or water. There is a provision to increase the swept area. The wiper used in this project is shown in the (Fig 2).



Fig 2 Wiper

3.5 Chassis

It is the system's foundation. It is connected to all of the systems and components. The chassis has a significant impact on the system's stability. It's either square, rectangular, or circular. The chassis is made up of an internal vehicle frame that holds the structure together. It can also serve as a shield for some internal components. The undercarriage of a vehicle, which consists of the frame, is an example of a chassis (on which the body is mounted). A rolling chassis is an assembly that includes the running gear, such as wheels and transmission, and sometimes even the driver's seat.

3.6 Caster wheel

A caster is a wheeled device that is usually attached to a larger object and allows for relatively easy rolling movement. Casters are special housings that include a wheel and make it easier to instal wheels on objects. From office desk chairs to shipyards, hospital beds to automotive factories, casters can be found almost anywhere. They come in a variety of sizes, from small furniture casters to large industrial casters. Cast iron, plastic, rubber, polyurethane, forged steel, stainless steel, aluminium, and other materials are used to make wheels. This caster has the ability to move in multiple directions. They can have one or two sets of raceways, allowing the caster to rotate 360 degrees while under load. The caster wheel used in this project is shoened in (Fig 3).



Fig 3 Caster Wheel

3.6 Heater

A heater is an electrically powered copper coil that uses the Joule heating process to convert electrical energy into heat. Electric current passing through the element encounters resistance, causing the element to heat up.

3.7 Bracket

Clamping of cleaning material is all it is. There are two brackets like this. The sponge is clamped on the first bracket, while the brushes are clamped on the second bracket using nut and bolts.

3.8 Fasteners

A fastener, also known as a fastening, is a piece of hardware that mechanically connects or affixes two or more objects. Fasteners are commonly used to create non-permanent joints, which can be removed or dismantled without causing damage to the joining components. Titanium, aluminium, and various alloys are also common metal fastener construction materials. When selecting a fastener for a specific application, it's critical to understand the application's requirements in order to select the right material for the job. In our project, we consider the following factors when selecting a fastener for the application:

- Environment, including temperature, water exposure, and potentially corrosive elements
- Installation process
- Materials to be joined
- Reusability
- Weight restrictions

IV. Development Of Floor Cleaning Machine And Its Performance

A floor cleaning machine is an electrically powered machine that cleans the floor and contributes to environmental cleanliness. This floor cleaning machine is capable of cleaning/mopping, drying/heating, and vacuuming/suctioning. Although the construction and design of this floor cleaning machine appear to be simple, it is extremely effective.

4.1 Model diagram

In modeling, AUTOCAD software is used to design all the parts of the project. Then assemble all the parts into finished parts by using AUTOCAD 2017. Modelling of machine helped us to get an idea of how will the final machine look and make necessary changes in design and structure of machine.

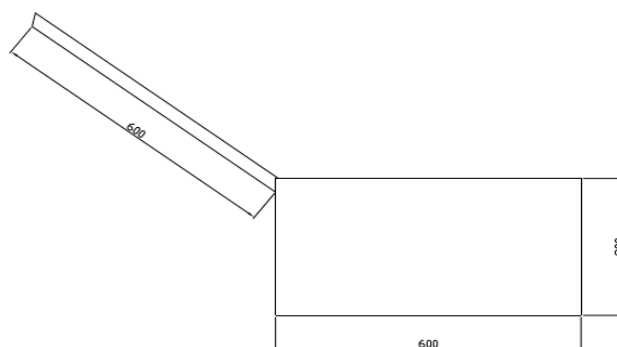


Fig 4 -2D diagram

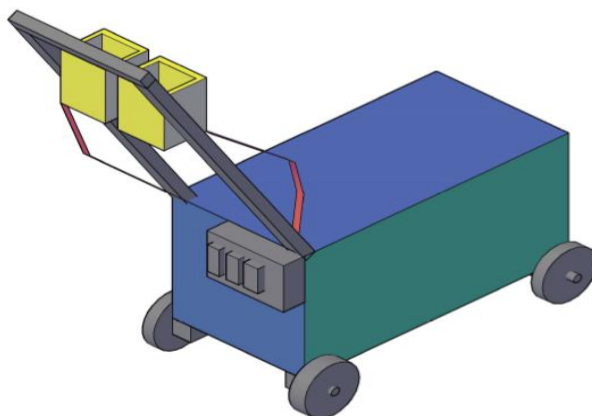


Fig 5 - 3D Model diagram

4.2 Project diagram



Fig 6–Developed model

V. Conclusion

In this project, we created a floor cleaning machine that can clean, mop, and vacuum at the same time. The main goal of this project is to assist people in reducing the amount of time and effort they spend in cleaning process. Cleaning or mopping, drying or heating, wiping water from the floor, and finally collecting dust and other waste from the floor with the help of a vacuum all these process are possible applications for this machine. This developed Multi-Functional Floor cleaning machine shows the effective utilization and implementation in a typical Indian household application.

FUTURE SCOPE

In further this machine can be converted into a fully automatic unit with the introduction of an automatic spraying mechanism. The solution can be sprayed at regular intervals using a pump and timer-controlled mechanism, resulting in efficient use. In addition, it also save space and money by reducing the machine's size.

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