

Design Modification and Fabrication of Eco-Friendly Cleaning Machine

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Abstract: *With the growth of technology, researchers are paying greater attention to automated floor cleaning devices in order to make mankind's existence more comfortable. The concept is gaining traction in developed countries, although it is still unpopular because to design complexity, machine costs, and power tariff running costs. A manual floor cleaning machine is proposed in this project. Early in the day, a floor is cleaned with a broom that is controlled by a human hand. This requires a continual movement of the human hand, which is exhausting and time demanding. The goal of this project is to provide a modernised procedure for wet and dry floor cleaning. This equipment is capable of cleaning floors in both dry and wet conditions. It also has a dust storage box. It was decided to create a prototype model that uses a DC drive powered rotary brush with pneumatic controlled dust shifting to assist users in removing waste and maintaining a clean and hygienic environment, thereby avoiding health inequalities and safety concerns for both workers and the general public.*

Keywords: Eco-friendly cleaning machine, Road Cleaner, Manually Operated

I. INTRODUCTION

Cleaning is a must-have skill for today's generation. In general, the floor in the home must be cleaned on a regular basis. This machine is responsible for the design and manufacture of floor cleaning machines. The major goal is to merge the functions of three separate devices: a vacuum cleaner, a dryer, and a mop. Many different types of floor cleaning machines are available on the market, all with high ranges and weights. As a result, they are not affordable to everyone, both in terms of weight and cost. For this function, a variety of machineries are extensively utilised. As a result, a multi-purpose and cost-effective floor cleaning machine must be designed and developed. When it comes to weight criteria, machine assembly, and machine handling, the machine is extremely adaptable. It's straightforward to put together and operate. This machine is simple to run for everyone. The machine's size is also portable, allowing us to move it from one location to another with ease. As a result, brushes [Industrial roller brush] replace the vacuum approach in our project. This system aids in the removal of solid trash (wood, vegetable waste, etc.), plastic objects, and other stuff. This initiative saves money by reducing human labour, time, and energy usage.

A manually operated floor cleaning is developed with major list of objectives: -

- To achieve simultaneous dry and wet cleaning in a single run.
- Lower Maintenance Cost and Time.
- Required less cleaning time.
- Clean more space in less time.

II. HISTORY

According to historical records, carpet cleaning procedures first appeared in the nineteenth century. In Europe and North America, the Industrial Revolution sparked new views about hygiene. People used to cover their carpets with druggets, or thick, heavy woollen items that spread underneath tables and other exposed areas, before the Industrial Revolution. Spills and other stains were not a problem with Druggets. While on vacation or hosting social gatherings in

their houses, wealthy people covered their carpets with canvas fabric. Houses filled with dust, grime, and soot due to a lack of ventilation, prompting residents to look for ways to clean them.

At the period, people put a high value on their homes, prompting a creative mind set to clean them more effectively. One of the most prevalent carpet cleaning methods entailed brooming carpets to remove sand, dust, and soot; unfortunately, this procedure failed to remove stains. Effective stain removal procedures did not exist until the 1830s, when inventive housewives documented their ink, grease, and oil-cleaning secrets. Scrubbing the carpet with lemon juice and a hot loaf of bread was one stain removal approach. The introduction of the first manually-operated vacuum cleaner in the late 1860s and 1870s revolutionised carpet cleaning practises. The vacuum cleaner made it easier for individuals to keep their homes clean on a daily basis.

In 1868, Ives W. McGuffey created the Whirlwind, which was the first manually operated vacuum cleaner. The Whirlwind was small, light, and difficult to control. Other inventors in the United States and Europe created their own manually operated vacuum cleaners. Readers may receive a variety of expert cleaning tips in numerous periodicals by the 1880s. One approach required scrubbing the carpet with a flannel cloth and then rinsing it with cold water after mixing water and bull's gall. Because carpet had become unfashionable throughout the 1920s and 1930s, the vacuum cleaning sector went silent. Most participants, however, agreed that rugs needed to be vacuumed before being shampooed. The carpet cleaning and flooring industries have refined their systems and chemicals over time to clean more effectively

III. LITERATURE REVIEW

The literature of various researcher's on the cleaning machine has been studied & summary of their contribution is presented below:

[1] Arjun V Murali et al. (2017) in their research, they work on floor cleaning machine. Their aim to develop and modernized process for cleaning the floor with wet and dry. At first dust is collected from vacuum cleaner. After that Water is sprayed from water tank and floor cleaning is done by rotating press which is coupled to the DC motor. Fan is used to dry the water which is fitted to the Back side of the vehicle.

[2] Mr. S. Rameshkumar et al. (2018) in their research, they work on Design and fabrication of multipurpose floor cleaning machine. In their work, modelling and analysis of the floor cleaning machine was done using suitable commercially available software. From the finite element analysis, they observe that the stress level in the manually operated floor cleaning machine is within the safe limit.

[3] Samarth G. Gaikwad et al. (2019) in their research, they work on Design and development of multifunctional floor scrubber and cleaner. They focused on to design and develop a multifunctional floor scrubber and cleaner which will substantially reduce the cleaning time and cost of the machine. At the same time, the floor cleaning machine should be capable of cleaning rough as well as smooth floors and inaccessible corners effectively. Through efficient project management, aspects like minimization of manufacturing and operational cost, aesthetic and ergonomic considerations were taken into account. Eventually this machine will lead to hefty decrease in time, money and effort.

[4] Shubham Khade (2017) In his research, he works on multi-use floor cleaning machine. He developed machine which is capable of performing cleaning of floor and corners effectively, semiautomatic water spray, cleaning of byre, dry as well as wet cleaning tasks. This floor cleaning machine is designed by keeping the basic considerations for machine and operational cost reduction, efforts reduction, environment friendly and easy handling.

[5] Shubham Antapurkar (2018) in his research, he works on Arduino based dry and wet automatic floor cleaner. His aim is to construct a floor cleaner which will be fully automatic providing dry and wet cleaning as well as UV sterilization. The current market is occupied by cleaners with only one or two functionality. For its cost reduction and simplicity, he is using Arduino. The cleaner will be a step for providing comfortable life by resolving problems in traditional floor cleaning methods.

[6] Ms. R. Abarna et al. in their research, they work on Design and fabrication of automatic floor cleaning machine. Their system enables cleaning of the floor by the help of highly stabilized and rapidly functionalized electronic and mechanical control system. Current project work targets to use automatic floor cleaner for large floor in household purposes and office floors. The cleaning purpose is specifically carried out by continuous relative motion between a scrubber and the floor surface.

[7] Himani Patel (2019) in her research, she works on wireless multipurpose floor cleaning machine. She focused on the problems of long wires so to overcome this problem she use battery system which can be rechargeable when electricity is available and work as required.

IV. PROBLEM FORMULATION

Some dust and dirt particles may remain on the floor during manual cleaning, and due to the movement of air, dirt and dust particles transfer from one surface to another, causing problems during cleaning and increasing physical labour. As a result, there is little motivation to clean the surface, and as a result, it takes longer. During the rainy season, muddy water is dumped on the corner of the wall, and manual cleaning is unable to remove all of the water from the surface of the floor, resulting in a sleepy surface and potentially increasing the risk of accidents. Additionally, water that remains on the corridor enters the rooms, increasing the risk of accidents. Due to the uneven surface of the corridor or floor, the intended cleaning is not reached during wet cleaning of the surface, and backflow of the water occurs, which tends to increase manual effort and makes cleaning the uneven surface of the floor more difficult and time consuming. As a result, it was decided to alter the design and build an environmentally friendly cleaning equipment.

2.1 Scope of Work

1. Cleaning of railway station, Bus Stand, road surfaces, College Area.
2. It can be widely used in industrial sector.
3. To reduce human efforts.
4. To save the time.
5. To reduce the cost.

2.2 Aim and Objective

1. To develop a machine that helps in easy and quick cleaning.
2. To provide the alternative method for road cleaning.
3. To reduce human efforts.
4. To save the time.
5. To reduce the cost.
6. To prevent injuries due to tripping or slipping. Injuries due to slips and trips on level floors are a major cause of accidental injury or death. Bad practice in floor cleaning is itself a major cause of accidents.
7. To beautify the floor.
8. To remove stains dirt.

2.3 Research Methodology

To carry out the project work following Methodology is selected

- Literature Review
- Identification of critical design parameters
- Design Modification
- Fabrication of Eco friendly cleaning machine
- Testing

2.4 Technical Specification

Parameters	Specification
Wheel Material	Plastic, Stainless steel
Axle material	Mild Steel
Sweeper Material	Polypropylene/ plastic/ Steel
Frame Material	Steel

Gear ratio	1:3
Chain	Alloy steel
Shaft	25mm
Brush	Nylon(18 inch)

2.5 Types of Transmission Systems

1. Gear drive transmission
2. Belt drive transmission
3. Chain drives transmission

A Gear Drive Transmission

A transmission is a machine in a power transmission system, which provides controlled application of the power. Often the term transmission refers simply to the gearbox that uses gears and gear trains to provide speed and torque conversions from a rotating power source to another device.

B. Belt Drive Transmission

A belt is a looped strip of flexible material used to mechanically link two or more rotating shafts. A belt drive offers smooth transmission of power between shafts at a considerable distance. Belt drives are used as the source of motion to transfer to efficiently transmit power or to track relative movement.

C. Chain Drives Transmission

A chain drive is a chain of links passing over sprockets that makes one shaft start rotating another. A simple chain drive is shown in fig 3.3 Chain drives, gear drives and belt drive systems are all effective power transmission choices.



Gear Drive



Belt drives
Belt Drive



Chain Drive

2.6 Industrial Brush

A brush is a tool with bristles made of hair, wire, metal, synthetic fibres, or other natural materials linked to a wooden, plastic, wire, or metal handle. Some brushes have been designed to function with power equipment for heavy-duty tasks like removing paint or polishing metals.

Brushes come in a wide range of sizes and shapes, from hair artist brushes to brushes with a few of feet in diameter that are used to clean floors and polish metals. Brushes are shaped and designed to accommodate a variety of purposes. The brush is essentially an abrasive tool for cleaning and removing paint and other materials from a surface. It's also used to clean surfaces and improve the environment.



2.7 Frame

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. A chassis is an internal vehicle structure that supports and protects various internal sections of an artificial item during its creation and operation. 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 assemblage that includes the running gear, such as wheels and transmission, and occasionally even the driver's seat.



A. Design Calculation

Calculation

Design of Gear:-

Given:

- Power transmission ratio $i = 1.3$
- Gear speed $N_2 = 50 \text{ rpm}$

Assume:

- Shear stress $\tau = 28 \text{ N mm}^2$ / (assume)
- Arrangement: External we know $i = Z_2/Z_1 = N_1/N_2$

So, $1.3 = N_1/50$

$N_1 = 65 \text{ rpm}$

Torque requirement and selection of motor:-

We know $T = \pi/16 \times \tau \times d^3$

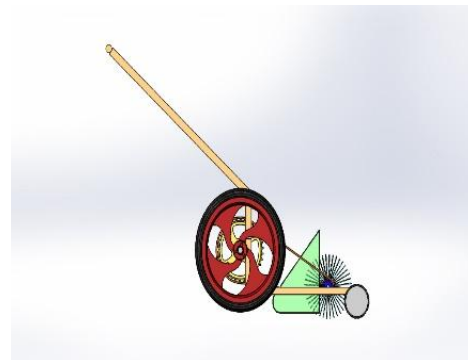
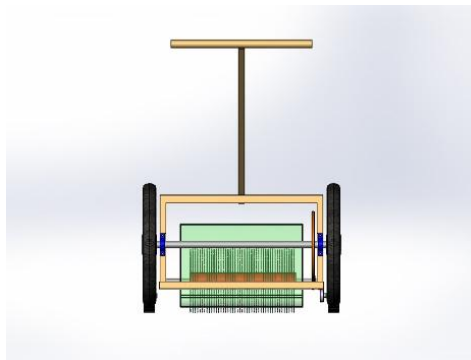
Given: Shaft diameter, $d = 25 \text{ mm}$

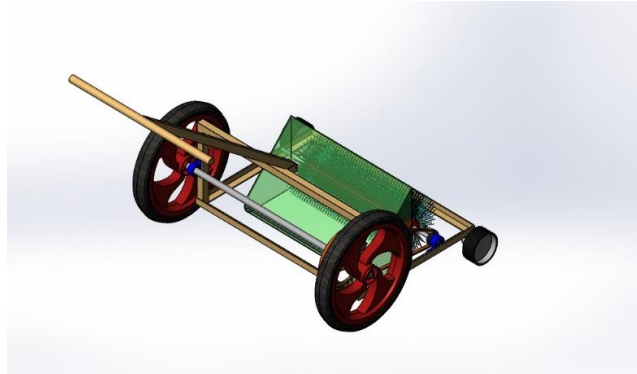
$T = \pi/16 \times 28 \times 25^3 = 85.902 \text{ Nmm}$.

Also we know

$P = 2\pi NT/60 = (2\pi \times 50 \times 85.90)/60$ $P = 0.45 \text{ Kw}$

III. BLOCK DIAGRAM





IV. CONCLUSION

In our project we introduced a floor cleaning machine. The main motive of the project is to cover the aspects of cleanliness in the society. The multiple applications provide a wide range of functions in which we can clean the pipe, scrubbing of surface for proper cleaning of the floor, remove dust and dirt from the road, provide a pick and place mechanism by which obstacles can be removed. This project will be very helpful for the society and plays a vital role in cleanliness of the country. The existing cleaning machine have some disadvantages, Few of those are the motor is not detachable and the high rpm leads to vibration of the whole system. If these features will be modified, this will work well. This design of automated floor cleaning system can be used to clean any kind of remote places. As the motors selected can consume much less power so it will be the power saving and cost saving too.

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