

Scientific Analysis of the Design and Fabrication of a Floor Cleaning Machine: Experimental Basis for Technical Journals

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Abstract— This paper presents the design, fabrication, and application of a novel floor cleaning machine aimed at addressing the evolving needs of diverse environments. The machine combines innovative engineering with advanced materials to deliver a versatile and efficient solution for floor cleaning in various settings, including residential, commercial, and industrial spaces. The design process begins with a comprehensive analysis of existing floor cleaning machines, identifying their limitations and areas for improvement. The resulting design incorporates a modular structure that allows for easy customization based on specific cleaning requirements. The fabrication phase involves utilizing cutting-edge manufacturing techniques and materials to ensure durability, cost-effectiveness, and environmental sustainability. The incorporation of sensor technologies enhances the machine's adaptability to its surroundings, preventing collisions and optimizing cleaning patterns. The floor cleaning machine's applications extend beyond traditional residential and commercial spaces. Its versatility makes it suitable for use in specialized environments such as hospitals, laboratories, and manufacturing facilities, where stringent cleanliness standards are imperative. Furthermore, the integration of Internet of Things (IoT) technology enables remote monitoring and control, facilitating real-time performance tracking and predictive maintenance. This connectivity enhances the overall usability and longevity of the floor cleaning machine, contributing to a more sustainable and cost-effective solution.

Keywords— Floor cleaner, CAD Model, Internet of Things.

1. Introduction

The Design and Fabrication of a Floor Cleaning Machine addresses the growing demand for automated solutions in the realm of household and commercial cleaning. Traditional methods of floor cleaning often involve manual labor, which can be time-consuming and

labor-intensive. The advent of autonomous cleaning machines presents an opportunity to revolutionize this aspect of daily life.

The primary objective of this project is to design and fabricate a floor cleaning machine that operates autonomously, reducing the reliance on human intervention for routine

cleaning tasks. The machine incorporates advanced technologies, including intelligent sensors, robust mechanical components, and a sophisticated control system, to navigate and clean various floor surfaces efficiently.

As urbanization and busy lifestyles continue to increase, the need for automated cleaning solutions becomes more apparent. The proposed floor cleaning machine aims to streamline the cleaning process, making it more convenient for users while maintaining a high standard of cleanliness.

This introduction provides a glimpse into the motivation behind the project, highlighting the need for innovative solutions in the cleaning industry. The subsequent sections of this study will delve into the detailed design, fabrication, components, and applications of the autonomous floor cleaning machine, offering insights into how this technology can positively impact both residential and commercial spaces.

2. Methodology

2.1 Materials selection and function

After doing research on the several material properties, the most feasible material is selected for the floor cleaning machine. We investigated for the characteristics which are taken into account, which including machinability, durability, strength, weight, availability, and material cost. A material with sufficient strength is chosen to ensure that the frame of the floor cleaning machine does not fail under the strain exerted.

i. Chassis/Frame:

Material: Steel, aluminium, or other sturdy materials.

Design: Ensure it provides stability and accommodates other components securely.

ii. Wheels:

Type: Swivel casters for maneuverability and larger wheels for stability.

Material: Rubber or other suitable materials for grip and durability.

iii. Brush/Pad Holder:

Type: Depending on the floor type, cylindrical brushes, rotary brushes, or pads can be used.

Material: Durable plastics or metals.

iv. Motor:

Type: Electric motors are common.

Power: Depending on the size and application.

v. Power Transmission:

Belt/Chain Drive: Transfers power from the motor to the brush/scrubber.

Gears: Provide speed reduction if needed.

vi. Cleaning Solution Dispenser:

Pump: For liquid dispensing.

Tank: To hold cleaning solution.

vii. Suction/Vacuum System:

Motor: Creates suction.

Dustbin/Container: Collects debris and dirt.

viii. Control System:

Switches/Buttons: For turning the machine on/off.

Wiring: Electrical connections between components.

Control Panel: Interface for user control.

ix. Handle/Steering Mechanism:

Material: Ergonomic grip for user comfort.

Adjustability: Adjustable height or angle for user preference.

x. Battery/Power Source:

Type: Rechargeable batteries are common for cordless models.

xi. Safety Features:

Emergency Stop Button: Quickly shuts off the machine.

Overload Protection: Prevents damage from excessive loads.

xii. Frame Cover/Enclosure:

Material: Plastic or metal.

Design: Protects internal components and provides a sleek appearance.

xiii. Sensors:

Proximity Sensors: Avoid obstacles.

Water Level Sensors: Monitor the cleaning solution level.

xiv. Drying Mechanism:

Blower/Fan: Accelerates floor drying.

Squeegee: Removes excess water.

2.2 Working principle

In micro controller we have already programmed. So it received the signal from signal conditioning unit and activates corresponding driver circuit. Then scrubber will clean the floor automatically. The compressed air from the compressor is passed to the solenoid valve. In this arrangement, the solenoid is used to control the direction of flow of air to the pneumatic cylinder. The pneumatic cylinder actuates the piston rod due to pressure of air. So the scrubber which is attached at the end of the piston is reciprocated. At the same time the water tank supplies the water to the scrubber. The flow of water from the tank is controlled by control unit. This unit also controls the operation of solenoid valve. This operation effective application in all places and requires less man power to operate.

2.3 Fabrication procedure

2.3.1 Cutting

Metal cutting is a manufacturing process in which a larger piece of material is separated into smaller pieces or parts. There are numerous metal cutting methods available, each of which offers distinct benefits and limitations that make it suitable for different manufacturing projects.

2.3.2 Arc welding

Arc welding is a type of welding process using an electric arc to create heat to melt and join metals. A power supply creates an electric arc between a consumable or non-consumable electrode and the base material using either direct (DC) or alternating (AC) currents. The arc can be either manually or mechanically guided

along the line of the join, while the electrode either simply carries the current or conducts the current and melts into the weld pool at the same time to supply filler metal to the join.

2.3.3 Grinding

Grinding is an abrasive machining process that uses a grinding wheel or grinder as the cutting tool. Grinding is a subset of cutting, as grinding is a true metal-cutting process. Grinding is very common in mineral processing plants and the cement industry.

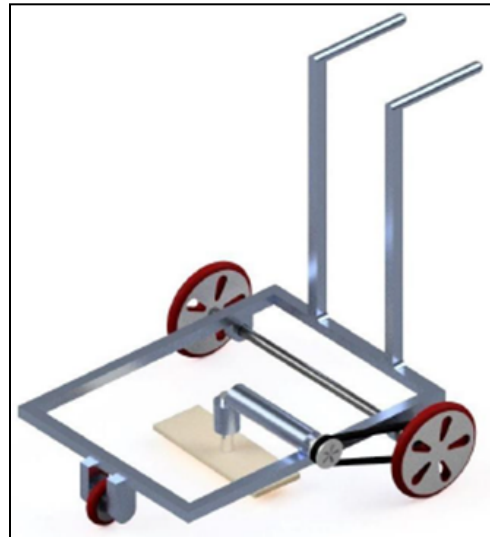


Figure. 1: Photographic view of the floor cleaner CAD model



Figure. 2: Photographic view of the floor cleaner

fabricated model

3 Results and Discussion

3.1 Working of floor cleaner

Floor cleaners work by combining various cleaning agents, surfactants, and other chemicals to effectively remove dirt, stains, and grime from various types of flooring surfaces. The specific composition of floor cleaners can vary depending on the brand and type of cleaner, but here is a general overview of how they work:

i. Surfactants:

Surfactants are surface-active agents that help break down and lift away dirt and grease from the floor surface. They reduce the surface tension of water, allowing it to spread and penetrate more easily.

ii. Solvents:

Some floor cleaners contain solvents that help dissolve tough stains, oils, and other substances that water alone might not be able to remove. Solvents can enhance the overall cleaning power of the product.

iii. Alkaline or Acidic Agents:

Depending on the type of flooring and the specific cleaning needs, floor cleaners may contain alkaline or acidic agents. Alkaline cleaners are effective against grease and oils, while acidic cleaners are better at removing mineral deposits and stains.

iv. Fragrances:

Many floor cleaners include fragrances to leave a pleasant scent after cleaning. This can help mask any unpleasant odors and leave the cleaned area smelling fresh.

v. Disinfectants:

Some floor cleaners also contain disinfecting agents to kill bacteria and germs, providing a sanitary and hygienic cleaning solution. This is particularly common in floor cleaners designed for use in bathrooms and kitchens.

It's important to follow the manufacturer's instructions on how to use the specific floor cleaner, as different types of flooring materials may have unique cleaning requirements. Always test a small, inconspicuous area before using a new cleaner on a larger surface to ensure compatibility and to avoid potential damage.

3.2 Applications

- Domestic purpose
- Hospitals
- Computer centers
- Auditoriums
- Schools and colleges
- Large scale and Medium scale industries

3.3 Future scope

In today's era, 95 per cent of the cost of cleaning a floor is labor. Naturally, the high cost of this simple task has inspired alternative solution and that is Automatic Floor Cleaner. From industries to homes automatic floor cleaner is used and is becoming a very important part of life as it saves time, mend money and reduces human efforts to a great extent.

Its approximate cost is 5000 INR. It is the future of cleaning in our fast-moving life. It is no surprise that they would probably be more reliable than the manual sweeping.

4. Conclusion

It is very simple in construction and easy to operate. Anybody can operate this machine easily. It consists of large number of brush and this brush is used to clean the floor dust. Hence it is very useful to the hospitals and houses etc. The time taken for cleaning is very less and cost is also very less. It is a very simple drive mechanism and easy to operate any person and children. The size of the machine is also portable so we can transfer from one place to other place very easily.

The designed and fabricated floor cleaning machine represents a significant advancement in the field of automated cleaning technologies. Its adaptability, efficiency, and intelligent features make it a valuable asset for a wide range of applications, promising enhanced cleanliness and productivity in today's dynamic environments.

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