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Cordless Electric Floor Cleaner

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Abstract: *Floor cleaning plays a vital role in maintaining hygiene across homes, offices, and public spaces. Traditional cleaning methods such as mopping and sweeping demand considerable human effort and often fail to achieve effective results. This project introduces a manually operated floor cleaning machine integrated with a motorized rotating brush, dust collection bin, water spraying system, and mop wiping unit. During operation, the rotating brush collects dust and debris into the bin, followed by a controlled water spray that moistens the floor. A mop positioned at the rear then wipes and dries the surface to ensure a clean finish. All mechanisms are operated through a simple on/off control, while the machine is manually pushed using a handle. The developed system achieves efficient cleaning with reduced manual effort and low power consumption. It is cost-effective, eco-friendly, and easy to operate, making it ideal for both domestic and commercial cleaning applications.*

Keywords: Floor Cleaning, Manually Operated, Motorized Brush, Water Spray, Dust Collection, Eco-Friendly.

I. INTRODUCTION

Cleanliness plays a crucial role in ensuring hygiene, comfort, and overall well-being in residential, commercial, and industrial environments. A clean surrounding not only prevents the spread of infectious diseases but also enhances productivity, aesthetics, and mental health. However, maintaining cleanliness through traditional methods such as mopping, sweeping, or scrubbing requires significant human effort and time. Moreover, these manual methods often fail to remove fine dust particles, stains, and debris effectively, especially over large floor areas or rough surfaces.

In response to these limitations, the demand for efficient, time-saving, and user-friendly cleaning solutions has grown rapidly. Mechanized and semi-automated cleaning systems have emerged as an alternative, offering improved performance and ease of operation. However, most existing automatic machines are either expensive or designed for specific industrial applications, making them less accessible for general domestic or institutional use.

To overcome these challenges, a **manually operated floor cleaning machine with a motorized brush mechanism with solar assisted battery powered electric floor cleaner** has been designed and developed. The proposed machine integrates mechanical movement with a motor-driven rotating brush that collects dust and debris into a storage bin. A water spray system positioned behind the bin ensures the surface is moistened before cleaning, while a mop unit wipes and dries the floor for a spotless finish. All functions are controlled through a single on/off switch, and the compact design allows for easy manual manoeuvring using a handle.

This innovation aims to reduce human effort, minimize cleaning time, and enhance efficiency while maintaining affordability and environmental sustainability. Its simple operation and portability make it suitable for a wide range of applications, including homes, schools, offices, hospitals, and public areas. By combining simplicity, efficiency, and cost-effectiveness, the proposed floor cleaning machine provides a practical solution to modern cleaning challenges.

II. PROBLEM STATEMENT

Traditional floor cleaning methods require high manual effort, consume more time, and are inefficient in removing fine dust and stains. Existing electric floor cleaners depend on grid power and are not energy efficient or eco-friendly. Hence, there is a need for a **portable, energy-efficient, and solar-powered floor cleaning machine** that reduces human effort and provides effective cleaning without relying on continuous electrical supply.

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III. LITERATURE REVIEW

Solar Powered Smart Multifunctional Floor Cleaning Robot (IJARSCT, 2022) — this paper presents a semi-automatic floor-cleaning machine powered by solar energy or battery/AC. They highlight motivation from power shortages and high utility costs: the solar-assisted design reduces dependence on grid electricity and lowers operational cost.

Relevance to your project: Since you are planning to include a solar panel for battery charging, this paper validates that a solar-assisted floor cleaner is both realistic and desirable — especially for areas with unreliable power supply or in energy-conscious designs.

Design and Development of Automatic Floor Cleaning Machine (IJARSCT, 2024) — describes a prototype floor-cleaning robot that can perform both wet and dry cleaning, using motors for brush/wheel drive, and uses IR sensors for obstacle detection.

Relevance: Their work shows that integrating motors, sensors, and automation logic to switch between wet/dry modes and to avoid obstacles is feasible. This supports your plan of adding sensors and control logic for enhanced functionality over a manual-only cleaner.

Current Automatic Floor Cleaning Machines: Limitations and Opportunities (IJARSCT, 2022) — a survey-article (or design-review) that discusses how many existing automatic or semi-automatic floor-cleaning machines are bulky, expensive, or heavy, restricting their use in small or confined areas (households, small institutions). The article proposes that a compact, modular design would be more practical.

Relevance: This observation underscores the gap that your project is trying to fill — a lightweight, motorized cleaning machine that remains simple, low-cost, and adaptable.

Additional works outside IJARSCT — professional or open-source — show that **rotary brush + water spray + dust collection + mop** configurations (i.e “floor scrubber” designs) remain a standard for manual or small-scale floor cleaning machines.

This gives a theoretical / industry-standard foundation for your mechanical layout (brush, wheels, bin, water tank + spray, mop), thus justifying your design approach.

IV. METHODOLOGY

The methodology of the proposed solar-powered floor cleaning machine is implemented through a systematic approach involving design, power management, mechanical assembly, and testing.

Initially, the system architecture is designed using a block diagram to integrate mechanical movement, electrical power flow, and cleaning mechanisms. A **solar panel** is used as the primary energy source, which converts solar energy into electrical energy. The generated power is supplied to an **inverter,** which conditions the power and charges the **battery**. The battery stores energy and supplies power to the **BLDC motor**, ensuring uninterrupted operation even in low sunlight conditions.

The BLDC motor drives the **rolling brush** through a **chain and sprocket mechanism**, providing the required torque and rotational speed for effective floor scrubbing. The machine is manually pushed using a handle, causing the **wheels and axle** to move the system forward. A **water tank and sprayer** are integrated to spray water onto the floor surface, loosening dirt and stains before brushing. The rotating rolling brush scrubs the floor and directs the loosened dust and debris into the **dust bin** for collection.

Finally, the complete system is tested under real-time operating conditions to evaluate cleaning efficiency, power consumption, ease of operation, and reliability. Necessary adjustments are made to optimize performance and ensure effective and sustainable floor cleaning

V. WORKING

The operation of the solar-powered floor cleaning machine begins when the user pushes the system using the handle, causing the wheels and axle to move the machine forward. The solar panel generates electrical energy, which is supplied to the battery through an inverter for storage. The stored energy powers a BLDC motor that drives the rolling brush through a chain and sprocket mechanism. Simultaneously, water from the tank is sprayed onto the floor surface to loosen

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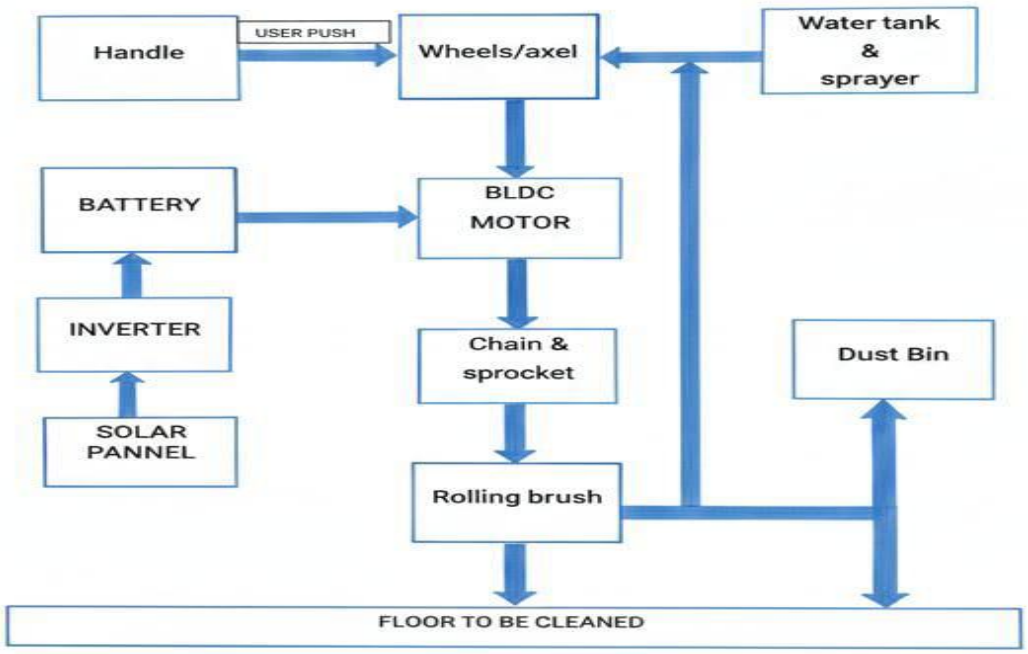
dirt and stains. The rotating rolling brush scrubs the floor effectively and sweeps the loosened dust and debris into the dust bin. This combined action of manual movement, motorized brushing, water spraying, and dust collection results in efficient and eco-friendly floor cleaning.

VI. BLOCK DIAGRAM



COMPENTS USED

A. Electrical Components

- Solar Panel
- Inverter
- Battery.
- BLDC Motor.
- Motor Controller / Driver
- Connecting Wires & Cables.
- Switches
- Fuse / Protection Circuit

B. Mechanical Components

- Handle.
- Wheels.
- Axle
- Chain and Sprocket Mechanism
- Rolling Brush
- Frame / Chassis

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C. Cleaning System Components

- Water Tank
- Water Sprayer / Nozzle
- Dust Bin

D. Miscellaneous Components

- Bearings
- Shafts & Couplings
- Fasteners (Nuts, Bolts, Screws)

VII. COMPONENTS DESCRIPTION

Solar Panel

The solar panel is the primary energy source of the proposed floor cleaning machine. It converts solar energy into electrical energy using photovoltaic cells. In this project, the solar panel is mounted on the top of the machine to receive maximum sunlight. The electrical energy generated by the panel is supplied to the inverter, which further supports battery charging. This reduces dependency on grid electricity and makes the system environmentally friendly.

Inverter

The inverter plays a key role in managing the electrical power generated by the solar panel. In this project, the inverter conditions the electrical output from the solar panel and ensures that suitable and stable power is supplied to the battery for charging. It also protects the battery from voltage fluctuations. By using an inverter, the system ensures continuous and safe power flow during operation.

Battery

The battery is used to store the electrical energy generated by the solar panel. In this project, the battery supplies power to the BLDC motor and other electrical components when the machine is in operation. It allows the system to work even in low sunlight or cloudy conditions, making the floor cleaning machine cordless and portable.

BLDC Motor

The BLDC motor is the main driving unit of the system. It converts electrical energy from the battery into mechanical rotational energy. In this project, the motor is connected to the chain and sprocket mechanism, which drives the rolling brush. The use of a BLDC motor ensures high efficiency, low power consumption, and longer operational life.

Motor Controller

The motor controller is used to regulate the operation of the BLDC motor. In this project, it controls the speed and smooth starting of the motor, preventing sudden jerks. It also protects the motor from overcurrent conditions, ensuring safe and reliable operation.

Chain and Sprocket Mechanism

The chain and sprocket mechanism is used to transfer rotational motion from the motor shaft to the rolling brush. In this project, it provides the required torque and speed reduction needed for effective floor scrubbing. This mechanism ensures reliable power transmission with minimal loss.

Rolling Brush

The rolling brush is the primary cleaning component of the system. In this project, it is mounted at the bottom of the machine and directly contacts the floor surface. When rotated by the motor, the brush scrubs the floor, loosens dust and stains, and pushes the debris towards the dust bin for collection.

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Water Tank

The water tank is used to store water or cleaning solution required for wet cleaning. In this project, the tank is mounted on the frame above the brush assembly. It supplies water to the sprayer, which helps in loosening dirt and improves cleaning efficiency.

Water Sprayer

The water sprayer sprays water evenly onto the floor surface ahead of the rolling brush. In this project, it helps soften dirt and stains before brushing, reducing the load on the motor and improving overall cleaning performance.

Dust Bin

The dust bin is used to collect the dirt and debris swept by the rolling brush. In this project, the dust bin is placed behind the rolling brush so that loosened dust is directly collected. It is designed to be removable for easy cleaning and maintenance.

Handle

The handle is used by the operator to push and guide the floor cleaning machine. In this project, it allows manual control of direction and speed, reducing the complexity of the system while ensuring ease of use.

Wheels

The wheels support the movement of the machine over the floor surface. In this project, they reduce friction and make the system easy to push manually. The wheels are mounted on an axle for smooth rotation.

Axle

The axle connects the wheels and supports their rotation. In this project, it maintains balance and provides structural support for the movement system.

Frame / Chassis

The frame is the structural base of the entire system. In this project, all electrical and mechanical components such as motor, battery, water tank, and dust bin are mounted on the frame. It provides rigidity, stability, and durability to the machine.

Switches

Switches are used to control the ON and OFF operation of the motor and water spraying system. In this project, they ensure safe and convenient control during operation.

Connecting Wires

Connecting wires are used to interconnect all electrical components. In this project, they ensure proper transmission of electrical power from the solar panel and battery to the motor and control units.

Bearings

Bearings are used in rotating parts such as wheels and brush shaft to reduce friction. In this project, they improve efficiency and extend the life of rotating components.

VIII. ADVANTAGES

Low Power Consumption

Uses a small 12 V DC motor and battery, making it energy-efficient compared to commercial cleaning machines.

Low Cost and Simple Construction

Made using easily available materials (mild steel, nylon brush, plastic tank).

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Affordable for small institutions, shops, and households.

Reduced Manual Effort

The motorized brush performs the main cleaning action, minimizing physical strain on the operator.

Dual Cleaning Action

Combines dry cleaning **(**brush + dust bin**)** and wet cleaning **(**spray + mop**)** in one compact design.

Eco-Friendly Operation

Works on a rechargeable battery, so it produces no emissions and reduces chemical usage.

Ease of Maintenance

Components like brushes, mop cloth, and water tank are removable and replaceable.

Portable and User-Friendly

Lightweight frame with wheels makes it easy to move and operate manually.

Single ON/OFF switch control simplifies operation.

Water Efficient

Adjustable spray nozzles allow controlled water flow, preventing wastage.

IX. LIMITATIONS

Limited Battery Backup

Cleaning time depends on battery capacity (e.g., 12 V 7 Ah lasts about 30–45 minutes).

Manual Pushing Required

Even though the brush is motorized, the unit still needs to be **pushed manually** by the operator.

Not Suitable for Heavy Industrial Cleaning

The system is designed for light to medium cleaning — not for oily or heavy debris surfaces.

Limited Water Storage

Small tank (3–10 L) restricts continuous cleaning duration.

Brush Wear and Maintenance

Rolling brush requires **periodic replacement** as bristles wear out over time.

No Automatic Dirt Disposal

The collected dust must be **manually emptied** from the bin.

X. APPLICATIONS

Educational Institutions

Classrooms, corridors, and laboratories where large areas need quick, clean maintenance.

Offices and Commercial Buildings

For daily floor cleaning to maintain hygiene with minimal manpower.

Hospitals and Clinics

Suitable for cleaning smooth surfaces where cleanliness is critical.

Shopping Malls and Supermarkets

Used during non-business hours for dust and stain removal.

Residential Homes and Apartments

Ideal for tiled or marble floors to reduce daily cleaning effort.

Railway Stations, Bus Stands, and Airports (Small Areas)

For quick cleaning of waiting halls and passages.

Industrial Canteens or Workshops

For cleaning workshop floors or semi-industrial surfaces that do not involve oil or heavy debris.

XI. CONCLUSION

The proposed automatic cleaning system has been successfully designed and developed to reduce human effort and improve cleaning efficiency. The system integrates both mechanical and electrical components, such as the mop drive

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motor, water pump, timer control, and manual control panel, to perform coordinated cleaning operations. The motorized roller mop effectively removes dust and stains, while the water pump and spray nozzle ensure uniform water distribution and cleaning coverage.

By automating the cleaning process with adjustable speed and water flow controls, the system provides flexibility for different surface types and cleaning requirements. This project demonstrates the potential of simple electromechanical integration in developing cost-effective and eco-friendly cleaning equipment suitable for domestic, institutional, and industrial applications.

In conclusion, the developed system offers a practical solution for maintaining cleanliness with minimal manual intervention, thereby saving time, energy, and labour while ensuring hygiene and consistent cleaning performance.

XII. FUTURE SCOPE

Automation Enhancement: The system can be upgraded with sensors (like ultrasonic or infrared) to detect obstacles, dirt intensity, and floor boundaries for autonomous operation.

Smart Control Integration: Incorporating microcontrollers or IoT modules can enable remote operation and monitoring using smart phones or wireless networks.

Battery-Powered System: Future versions can use rechargeable batteries or solar-powered systems to eliminate dependency on external power supply and enhance mobility.

Self-Cleaning Mechanism: The mop and brush units can be designed with self-cleaning or self-drying features to maintain hygiene and reduce maintenance time.

Automatic Water Level and Waste Detection: Sensors can be added to monitor water levels in the tank and dust bin capacity to alert users for refilling or emptying.

Compact and Modular Design: Further design optimization can make the system more compact, lightweight, and easier to transport for domestic and industrial cleaning applications.

Use of Advanced Materials: Employing durable, lightweight, and corrosion-resistant materials can improve the system's lifespan and energy efficiency.

AI-Based Cleaning Patterns: Artificial intelligence can be introduced to learn and adapt cleaning paths based on room layout and dirt concentration for maximum efficiency.

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