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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 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

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. IJAR Scientific Journals

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. IJAR Scientific Journals+1

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 floor-cleaning machine operates when the user gently pushes the handle, causing the chassis and wheels to move smoothly across the surface. The stored battery energy is used to power the BLDC motor that drives the cleaning mechanism. When the motor receives power, it rotates at high speed, and this motion is transferred to the cylindrical rolling brush through a chain and sprocket arrangement, ensuring continuous and efficient scrubbing action. Simultaneously, the water sprayer pumps water or cleaning solution from the tank and distributes it onto the floor to soften dirt and loosen debris. As the brush rotates over the wetted floor, it scrubs and sweeps dust, hair, and waste particles toward the dust collection chamber. The dust bin stores all collected waste, preventing it from spreading back onto the floor. With this combined action of water spray, rolling brush scrubbing, and dust collection, the floor becomes clean, smooth, and hygienic after each pass of the machine.

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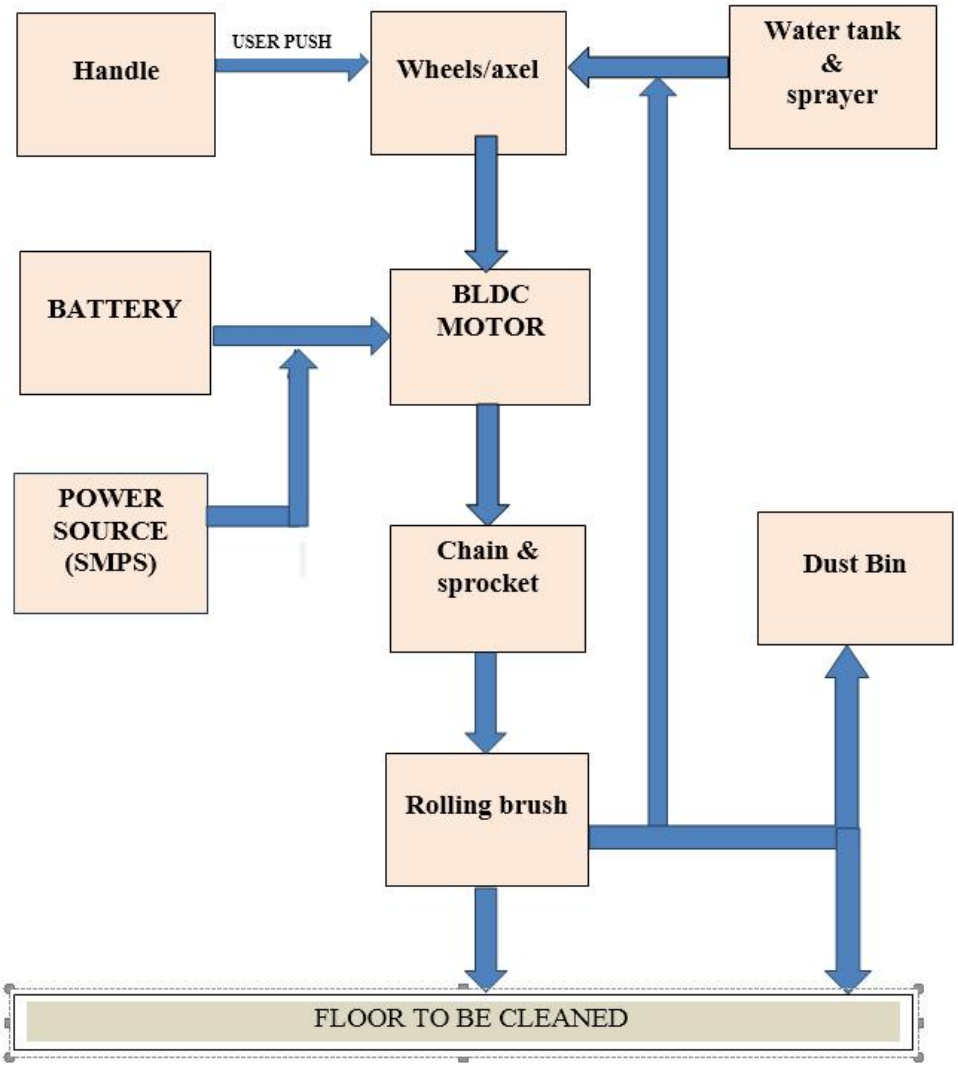
VI. BLOCK DIAGRAM



COMPENTS USED

A . Electrical Components

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

B. Mechanical Components

- Handle.
- Wheels.
- Axle

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- Chain and Sprocket Mechanism
- Rolling Brush
- Frame / Chassis

C. Cleaning System Components
- Water Tank
- Water Sprayer / Nozzle
- Dust Bin

D. Miscellaneous Components
- Bearings
- Shafts & Couplings
- Fasteners (Nuts, Bolts, Screws)

VII. COMPONENTS DESCRIPTION

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

Handle

This is the part the user holds to push the machine. It transfers manual force to move the machine forward. No power is used here; only user push drives the wheels

Wheels/Axle

Connected to the handle movement. When the user pushes the handle, the wheels rotate. The axle connected to the wheels helps transfer rotational motion to chain & sprocket if required

WaterTank&Sprayer

Stores water or cleaning liquid. A sprayer mechanism (manual or motor-driven) sprays water onto the floor. Helps loosen dust, stains, or dirt before brushing

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Rolling Brush
Main cleaning component of the system. Rotates at high speed and scrubs the floor surface. Loosens dust, dirt, and waste particles.

Dust Bin
Collects dust and debris swept up by the rolling brush. Positioned behind or above the brush to collect waste efficiently.

Floor to be Cleaned
Water + brush scrubbing removes dirt. Dust is collected inside the dust bin. Clean, dry floor results after the process

VIII. ADVANTAGES

1. Low Power Consumption
o Uses a small 12 V DC motor and battery, making it energy-efficient compared to commercial cleaning machines.
2. Low Cost and Simple Construction
o Made using easily available materials (mild steel, nylon brush, plastic tank).
o Affordable for small institutions, shops, and households.
3. Reduced Manual Effort
o The motorized brush performs the main cleaning action, minimizing physical strain on the operator.
4. Dual Cleaning Action
o Combines dry cleaning (brush + dust bin) and wet cleaning (spray + mop) in one compact design.
5. Eco-Friendly Operation
o Works on a rechargeable battery, so it produces no emissions and reduces chemical usage.
6. Ease of Maintenance
o Components like brushes, mop cloth, and water tank are removable and replaceable.
7. Portable and User-Friendly
o Lightweight frame with wheels makes it easy to move and operate manually.
o Single ON/OFF switch control simplifies operation.
8. Water Efficient
o Adjustable spray nozzles allow controlled water flow, preventing wastage.

IX. LIMITATIONS

1. Limited Battery Backup
o Cleaning time depends on battery capacity (e.g., 12 V 7 Ah lasts about 30–45 minutes).
2. Manual Pushing Required
o Even though the brush is motorized, the unit still needs to be pushed manually by the operator.
3. Not Suitable for Heavy Industrial Cleaning
o The system is designed for light to medium cleaning — not for oily or heavy debris surfaces.
4. Limited Water Storage
o Small tank (3–10 L) restricts continuous cleaning duration.
5. Brush Wear and Maintenance
o Rolling brush requires periodic replacement as bristles wear out over time.
6. No Automatic Dirt Disposal
o The collected dust must be manually emptied from the bin.

X. APPLICATIONS

1. Educational Institutions
o Classrooms, corridors, and laboratories where large areas need quick, clean maintenance.

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2. Offices and Commercial Buildings
o For daily floor cleaning to maintain hygiene with minimal manpower.
3. Hospitals and Clinics
o Suitable for cleaning smooth surfaces where cleanliness is critical.
4. Shopping Malls and Supermarkets
o Used during non-business hours for dust and stain removal.
5. Residential Homes and Apartments
o Ideal for tiled or marble floors to reduce daily cleaning effort.
6. Railway Stations, Bus Stands, and Airports (Small Areas)
o For quick cleaning of waiting halls and passages.
7. Industrial Canteens or Workshops
o For cleaning workshop floors or semi-industrial surfaces that do not involve oil or heavy debris.

XI. CONCLUSION

The electric floor cleaner 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 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

1. Automation Enhancement: The system can be upgraded with sensors (like ultrasonic or infrared) to detect obstacles, dirt intensity, and floor boundaries for autonomous operation.
2. Smart Control Integration: Incorporating microcontrollers or IoT modules can enable remote operation and monitoring using smartphones or wireless networks.
3. Battery-Powered System: Future versions can use rechargeable batteries or solar-powered systems to eliminate dependency on external power supply and enhance mobility.
4. 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.
5. 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.
6. Compact and Modular Design: Further design optimization can make the system more compact, lightweight, and easier to transport for domestic and industrial cleaning applications.
7. Use of Advanced Materials: Employing durable, lightweight, and corrosion-resistant materials can improve the system's lifespan and energy efficiency.
8. 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.

RESULT

The developed manually operated floor cleaning machine was successfully fabricated and tested on various floor surfaces such as tiles, marble, and concrete. The performance was evaluated based on cleaning efficiency, ease of operation, power consumption, and water usage.

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