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Development of a User-Friendly and Manual Floor Cleaning Solution

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Abstract : *A motorized floor cleaner has been designed and developed to address the challenge of cleaning dry outdoor floors with sticky dirt and debris. The cleaner is powered by a rechargeable battery, making it portable and convenient to use. The motor drives the rotation of the mop, which ensures efficient cleaning with minimal effort. A water tank is integrated into the design to supply water to the mop, keeping it wet during operation and improving its ability to remove stubborn dirt effectively. The device is constructed using lightweight yet durable materials to ensure ease of handling and long-lasting performance, even in outdoor conditions. This innovative solution simplifies the cleaning process, providing an efficient and practical method for maintaining the cleanliness of outdoor areas. Testing has confirmed its effectiveness across various dry surfaces, highlighting its potential as a reliable tool for everyday cleaning tasks.*

Keywords – *Floor Cleaning, Cleaning efficiency, Manual operation, User-friendly design, Dry floor cleaner*

I. INTRODUCTION

The motor-type floor cleaner has been designed to solve the problem of cleaning tough dirt from dry outdoor floors in areas where mud and rain leave debris. A water tank is included to keep the mop slightly wet, which helps remove sticky dirt without wetting the entire floor. The mop is powered by a motor, allowing it to rotate steadily and clean more effectively. The water system is made to keep the mop just wet enough to work efficiently without soaking it[3]. User comfort has been considered by adding features that reduce strain and make the cleaner easy to use, even during long cleaning sessions. The cleaner is made to keep dry surfaces clean and in good condition. It is suitable for use in commercial, industrial, and residential outdoor areas[1]. It's simple and smart design makes it easy to maintain and use for different cleaning tasks, providing a reliable and practical cleaning solution.

II. PROBLEM DEFINITION

Hard-to-remove dirt, muck, and debris are common on outdoor floors, especially those in high-traffic areas or exposed to rain[1]. Because they are unable to regulate moisture levels or provide sufficient scrubbing force, traditional cleaning technique like using ordinary mops frequently fail to address these issues. Because traditional cleaning equipment cannot effectively remove sticky dirt without over-wetting the surface, the damp conditions make cleaning more difficult. Cleaning so turns into a tedious and ineffective chore, and outdoor flooring continue to be vulnerable to additional filth and grime accumulation[1]. Ineffective cleaning might also result in faster floor degradation and less visual appeal. This emphasizes the necessity for a workable and effective cleaning method that can remove dry floors and tackle the problem of tough dirt and debris without making the surface unduly slippery or challenging to maintain[3].

2.1 Objective

The main aim of this project is to develop an effective manual floor cleaner that uses mechanical components to improve cleaning performance and provide a practical solution for dry floors with sticky dirt. A water delivery system has been included to ensure the mop receives the right amount of moisture, enhancing its ability to remove dirt and grime. The water distribution system is carefully designed to be controlled, preventing the mop from becoming oversaturated while ensuring efficient cleaning. The durability and effectiveness of the materials used will also be assessed to ensure the cleaner performs well and remains durable, even when exposed to outdoor conditions. User testing will be conducted to gather detailed feedback on the design's usability and operational performance. This feedback will be used to make improvements, ensuring the floor cleaner meets practical requirements while offering comfort, reliability, and ease of use over time. These efforts aim to create a highly effective cleaning tool specifically designed for outdoor environments.

III. METHODOLOGY

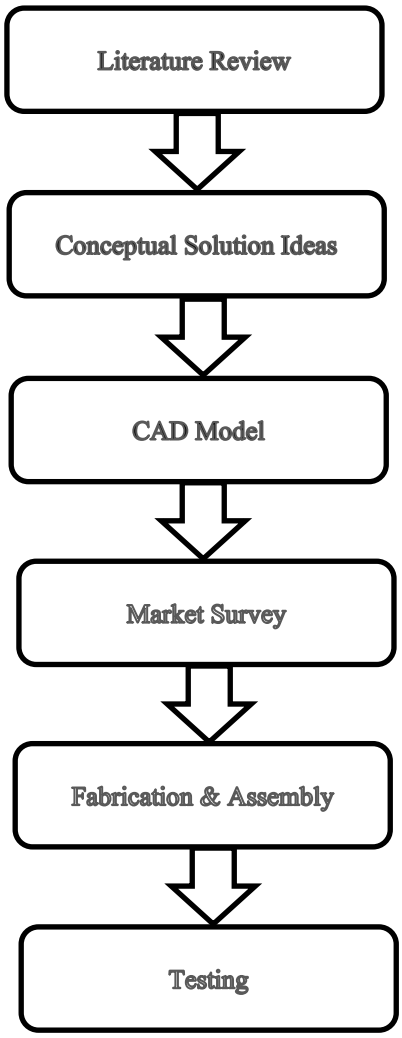

Fig 1. flowchart for proposed methodology

3.1 Market survey

A market survey was conducted to determine the costs of parts and materials needed to build the manual hand floor cleaner. Several stores were visited, and the prices of the required components were carefully examined to ensure cost-effectiveness and availability. The manual hand floor cleaner was designed to effectively clean tough dirt and debris from outdoor areas, particularly on damp floors. Unlike traditional methods, the cleaner was equipped with a water container to keep the mop wet during use, eliminating the need for a separate bucket and improving cleaning efficiency. The survey revealed that the prices of components varied significantly. For instance, the cost of a rechargeable 12V lithium-ion battery ranged between 400 and 500 rupees, while a 12V DC gear motor was priced between 1,000 and 1,500 rupees. The water pipe was found to cost between 50 and 100 rupees, and the ball valve for the water dispensing system was priced between 100 and 150 rupees. Through this survey, the affordability of the components was thoroughly analysed, and areas for potential cost reduction were identified without compromising the functionality or quality of the final product. The findings provided valuable insights into the feasibility of the project and the strengths and weaknesses of different designs. This analysis ensured that the materials chosen would meet both the performance requirements and budget constraints of the manual hand floor cleaner. The results of the survey played a crucial role in guiding the project toward a practical and affordable solution for addressing the issue of slippery outdoor floors.

Fig 2. rear wheel

Fig 3. 360^0 rotatable front wheel

3.2 CAD Model

The system was designed and modelled using SolidWorks software. The design includes a motor, a ball valve, wheels, a mop, a water tank, a water pipe, and a rechargeable battery. The main body was designed as a sturdy frame to provide stability and structural support.

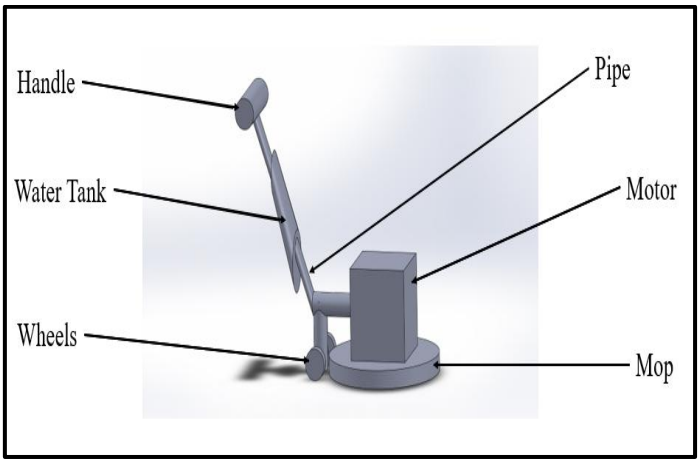

Fig 4. CAD Model

3.3 Fabrication & Assembly

Corrosion-resistant materials were used to create a sturdy yet lightweight frame for the manual hand floor cleaner, making it suitable for outdoor use. The sprocket, chain, and gear assembly were securely mounted onto the frame through precise drilling. Chains and sprockets were cut to the correct size to ensure efficient power transfer from the wheels to the mop. Bevel gears were installed to allow the mop to rotate smoothly by transmitting rotational force at an angle. A small water tank with a manual release valve was attached to the frame to distribute water effectively to the mop.

The assembly process began with the construction of a stable frame. The sprocket and chain system were then aligned to connect the wheels to the mop mechanism. The water tank was securely attached, with tubing directed to control water flow, and bevel gears were carefully positioned to avoid any misalignment. Once the assembly was completed, the device was tested to ensure that all parts worked together properly, confirming that the cleaner was effective on muddy and damp surfaces.

3.4 Testing

After assembly, a series of tests were conducted on the manual hand floor cleaner to assess its performance, durability, and efficiency on damp, slippery outdoor surfaces. The alignment of the bevel gear was checked to prevent slipping or jamming during use. Initial tests were carried out to ensure the proper alignment of the chain and sprocket system, which allowed the mop to rotate smoothly as the wheels moved forward. Functionality tests were performed on various surfaces, such as concrete and tiled outdoor areas, to evaluate the cleaner's ability to remove mud, debris, and water effectively. The water distribution system was tested to ensure the proper amount of water was released onto the mop without excessive leakage, enabling effective cleaning of muddy or sticky spots.

Durability tests were conducted by repeatedly using the cleaner in simulated outdoor conditions, exposing it to wet and rough surfaces to observe wear on the chain, gears, and frame. User feedback was gathered through operational tests to assess the cleaner's overall effectiveness, comfort, and ease of use. This ensured that the cleaner could be operated efficiently without excessive force. The tests confirmed that the cleaner's design was reliable, durable, and effective for outdoor cleaning tasks.

IV. CONCLUSION

The motorized mechanism of the motor-type floor cleaner enhances cleaning by providing a steady, strong scrubbing action, which is important for removing dirt and grime, making it a powerful option for cleaning wet and slippery outdoor floors. The motor-powered mop head vigorously scrapes surfaces, making it effective at removing stubborn stains and sticky areas. This increased cleaning power helps to effectively remove dirt and debris, improving floor cleanliness and maintaining safety.

Additionally, the motor-type cleaner offers convenience by drawing water directly from a wall connection to the water tank, allowing continuous cleaning without the need for frequent refills. This feature is particularly useful for larger areas. The ergonomic design reduces physical strain, making it easier to move across various floor surfaces, especially uneven ones. Furthermore, the cleaner can be fitted with different pads or brushes, enhancing its adaptability for tasks ranging from light maintenance to heavy-duty scrubbing. The motor-type floor cleaner is a reliable choice for maintaining outdoor floors due to its powerful cleaning ability, versatility, ease of use, and water connection feature.

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REFERENCES

Journal Papers:

[1] Kim, S., & Lee, T. (2021). "Effectiveness of Various Cleaning Methods in Outdoor Environments: Addressing Moisture's Impact on Performance." Journal of Environmental Hygiene, 58(4), 214–229.
[2] Johnson, L. (2020). "Health Implications of Mold and Mildew in Wet Outdoor Areas." International Journal of Public Health and Safety, 46(3), 178–191.
[3] Zhao, M., & Chen, R. (2019). "Ergonomic Considerations in Cleaning Tool Design: Enhancing User Efficiency and Safety." Journal of Occupational Health and Ergonomics, 33(2), 85–99.
[4] Smith, J. (2018). "Safety Challenges of Wet Outdoor Surfaces and Their Impact on Cleaning Routine." Journal of Outdoor Safety and Maintenance, 41(5), 310–324.