Miniature Washing Machine

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Abstract — This research paper presents an innovative and fully automatic Miniature Washing Machine. They are designed for undergarments, socks, and similar clothes washing. The fully functional model will be placed in places like everyone's home, which is majorly required in areas like hostels to maintain hygiene. This project itself represents a traditional washing machine but on a smaller scale. It's not convenient to use a traditional washing machine to just wash such small and regularly worn clothes and at the same time is not good if viewed from a hygienist's perspective. It has become a much more easily accessible, user-friendly, and portable project that comes into help and is much more convenient than washing machines in terms of conserving some factors like water and energy. The project integrates a DC motor, preform containers, I.V. infusion set, agitator, switch regulator, and ultrasonic sensor.
The research outlines the methodology, tools, and practical application of Miniature Washing Machines in addressing contemporary urban challenges.

Keywords: Miniature Washing Machine, Real-time cleaning, Ultrasonic sensor, DC motor, switch regulator.

INTRODUCTION

The demand for hygiene maintenance and a portable washing machine in public necessitates innovative solutions. This research focuses on a state-of-the-art Miniature Washing Machine designed for household clothes cleaning as well as places like hostels wherein hygiene is a major concern and which can be achieved on a big scale with this project.

The integration of a DC motor and switch regulator ensures real-time washing, offering unparalleled accuracy in the washing of small garments, and socks, The development of such a framework ensures accurate washing effortlessly and in less time with conservation of many factors.

User-centric design principles guide the inclusion of user-friendly operations and modes like washing and rinsing making an effortless washing process. The intentional focus on user experience sets the system apart, providing to practical needs and expectations of clean clothes among users in everyday running environments.

Beyond user convenience, the system addresses a broader challenge- thorough washing of clothes. By providing a connection between the switching regulator and the motor, the system becomes a proactive tool for properly washing dirty socks and garments.

The comprehensive approach of this research encompasses the integration of an agitator, DC motor which is attached to the preform containers. This paper not only outlines the methodology and tools but also emphasizes the practical application and impact of Miniature Washing Machines in necessary places.

II. LITERATURE REVIEW

I. METHODOLOGY/EXPERIMENTAL

A. Components

For the assembly of a 3D model of a Mini Washing machine, we used the following components:

1. DC Motor

The SP Electron DC Motor RS-775 is a high-performance motor for projects like mini washing machines. Operating at 12 volts, it provides significant torque and power while maintaining low noise levels. Equipped with double ball bearings, it ensures durability and smooth operation. With a maximum speed of 12000 RPM, it offers efficient performance.

2. Switch Regulator

A versatile PWM motor speed controller compatible with various voltage inputs ranging from 1.8V to 12V and capable of handling currents up to 2Amps. This controller allows precise control over the motor speed A switch regulator, or PWM controller, controls the speed of a DC motor by rapidly turning the power on and off. This changes the average voltage sent to the motor, which adjusts its speed. By adjusting the on-

off ratio, the controller efficiently manages motor speed with little heat generation, ensuring smooth and efficient operation. These controllers often have built-in safety features like overcurrent and thermal protection, making them perfect for use in robots, cars, and industrial machines.

3. Preform Container

Preform containers are like the building blocks for big plastic jars, weighing around 5 kg. They're made from a special type of plastic called PET. First, they're made by injecting melted plastic into molds. Then, they're heated up and blown into their final shape. This method makes sure the jars have the same thickness all around and are made well. It's used a lot in making things like food containers, and medicine bottles because it's efficient and reduces waste. Plus, these containers are strong and versatile.

A. Components used:

1. DC motor
2. Switch Regulator
3. Agitator
4. Ultrasonic Sensor
5. Preform Container

B. Block diagram

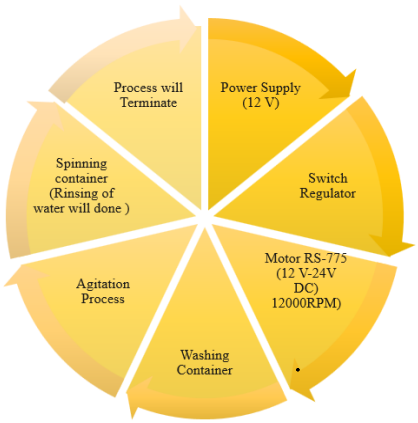

Fig 1. Block diagram of Mini Washing machine

C. Flowchart

The flowchart of the machine involves three steps as there are three major components.
[1]DC Motor
[2]Switch Regulator
[3]Agitator

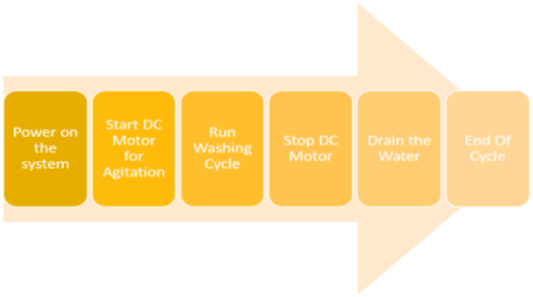

Fig 2. Flowchart of shoe cleaning machine

The Washing machine follows a three-step process for efficient operation. In the initial phase, Utilize a Switch Regulator to stabilize the voltage output Upon turning on Switch, the DC motor is activated. In the Second phase, Prepare the washing compartment by loading small garments and adding water along with detergent as required. In the Third phase, After the designated washing duration, turn off the control switch to stop motor activity, signaling the completion of the washing cycle. The Fourth Phase, Drain Water: Drain the water from the washing compartment and retrieve the cleaned garments, completing the laundry process.

D. Testing

The containers were filled with water and run through multiple washing cycles to ensure they could withstand the pressure and agitation without leaking or breaking.

B. The spinning action of the porous container was assessed to ensure effective water drainage and garment drying.

c.The amount of water and energy consumed per washing cycle was measured to assess the eco-friendliness and efficiency of the washing machine.

As we know torque is calculated by using the following formula:

$$T = \frac{p}{w}$$

T= TORQUE OF MOTOR
P=POWER OF MOTOR
ω = ANGULAR VELOCITY
BY PUTTING VALUES TO CALCULATE TORQUE

$$\omega = \frac{2\pi}{60} \times \text{RPM}$$

= 1256.64 RAD/S

P= 100 W

$T = \frac{p}{w}$

$= \frac{100}{1256.64}$

T= 0.0796N.M.

II. RESULTS AND DISCUSSIONS

Mini washing machine, powered by a DC motor and a 12V lead-acid battery via a motor driver, successfully cleans small garments.
It's compact and portable, using everyday materials, making it cost-effective and eco-friendly.
The design is user-friendly and energy-efficient.
Demonstrates practical innovation by turning common items into a functional device.
It's a practical and sustainable solution for small-scale laundry needs.
Reduced water consumption compared to traditional washing machines

Fig 3 .

III. CONCLUSION

The miniature washing machine with motor and switch regulator with agitator attached to the project helps for thorough washing of dirty clothes like undergarments, and socks. The conclusions are as follows:

A. Cleaning Efficiency:

The miniature washing machine was subjected to testing for water leakage and proper working as per the expectations, to evaluate washing off dirty socks. The result indicates a remarkable cleaning efficiency of _____ on average. The system demonstrated consistent performance in removing the stains and the dirt off socks, undergarments, etc.

B. Time efficiency:

The time efficiency of the Miniature washing machine was evaluated by measuring the time taken to wash some pairs of clothes. The average washing time was found to be 5 min to max, showcasing the system's quick and efficient washing process.

C. Portability:

This miniature washing machine being similar to the traditional washing machine, is smaller in size and can be carried around by the user and is user-friendly. The design makes it minimal making the project portable for users from one place to another.

D. Comparison with traditional washing machine:

Comparing the miniature washing machine to a regular washing machine, it's feasible, portable, and easy to use in design. As well as it makes it a better option for washing dirty socks and garments since it contributes to the conservation of energy and water to 70-80% on average.

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V. REFERENCES

[1] Tandale P, Shivpuje S, Ladkat S, Simran K, "Design of Washing Machine for Cleaning of Small Components", 2015, International Journal of Emerging Engineering Research and Technology.
[2] Hamzah Sakidin1, Pretesh Sudhakaran2, Muhammad Syaamil Saad3, Sarah Syamimi , "Development of eco-friendly washing machine ", 2017, MATEC Web of Conferences 131.
[3] Evangelos Papadopoulos and Iakovos Papadimitriou, " Modeling, Design and Control of a Portable Washing Machine during the Spinning Cycle",2001, IEEE/ASME International Conference on Advanced Intelligent Mechatronics Systems.
[4] Prof. Bhavesh Patel, " Research Paper on "Innovation in Design of Washing

Machine",2017, IJSRD - International Journal for Scientific Research & Development

[5] Mr. Rishikant Sahani, Saddam Husain Sheik , Sandeep Singh , Bhaskar Nishad, Bhashkar Singh, Santosh Kumar Yadav, "Design and Fabrication of portable washing machine", 2020, International Research Journal of Modernization in Engineering Technology and Science (IRJMETS)

[6] Satyam Agarwal, Jeemit Kansagra, Laxmi Narsimha Swamy, Dharmesh Jain, Prof. Bhavesh, Patel, "Innovation in Design of Washing Machine", 2017, IJSRD - International Journal for Scientific Research & Development

[7] Kambale Arjun, Mali Rhushikesh, Mulik Amit, Chavan Priyanka, Gholap Ashvini, Shankaradas Shilpa, "Portable Washing Machine By Using Solar System", 2020, International Research Journal of Modernization in Engineering Technology and Science(IRJMETS)