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VEGETABLE CLEANING MACHINE

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ABSTRACT: Root vegetables like potato, carrot, raddish, beet root and analogous vegetables need to be gutted before transporting from field to request. Washing vegetables before dealing them into the request, is an essential primary process, which reduces the face microbial cargo, while removing the field soil, dust, and indeed residual fungicides, therefore leading to the value addition of the product at the ranch position. impurity of vegetables is generally due to unsanitary civilization and marketing practices. The microorganisms and fungicides involved with the food if remaine unsanitized, can be critical from a public health point of view, because they can lead to health hazards. Washing is the primary and essential operation in the product and distribution of fresh root vegetables. A pristine sword, movable pedal- operated vegetable washer was developed. After gathering the Root vegetables like potatoes, carrots, radishes, etc. have to be gutted off the soil, remove the complexion patches and other microbial pollutants for a healthy and respectable yield for the consumers. typically the growers in India use Traditional styles to clean the root vegetables which are set up to be less effective in the cleaning processand also it's a time- consuming process that involves fresh labour.

KEYWORDS: vegetable cleaner, microbial load,brush cleaning,conveyor belt,Dc gear motor,lead acid battery.

1.Literature survey

Design and Fabrication of Root Vegetable Washer Mohammed DaniyalShariff1, Ifraz Ur Rahman2, ManishM3,Pavan Singh4, Prof. AbhilashM5 1,2,3,4, 5Maharaja Institute of Technology Mysore[1] from this paper Effective cleaning is essential for fresh root vegetables like carrots, radish, and ginger. Currently, small-scale farmers face challenges in accessing affordable and efficient cleaning solutions. To bridge this gap, a user-friendly, pedal-operated vegetable washer has been developed.This eco-friendly solution simplifies the post-harvest cleaning process, efficiently removing dirt, clay, and microorganisms from root vegetables. By replacing traditional labor-intensive methods, this innovative washer saves time, reduces labor costs, and enhances production quality. Trials of the pedal-operated vegetable washer yielded impressive results, with an average cleaning efficiency of 88.4% achieved across a range of vegetables, including carrots, radishes, potatoes, and ginger.Design and Development of Rotary Type Vegetable Cleaner Ms. Anjali Meshram1

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Dr. S. R.Ikhar2 1M.Tech Student 2Associate Professor[2] From this paper The efficient cleaning of root vegetables poses a significant challenge for agricultural practices, especially after pre-crop irrigation. Conventional hand-cleaning methods are labour-intensive, time-consuming, and costly. Therefore, the introduction of innovative technology in vegetable cleaning is crucial. This design aims to revolutionize the cleaning process by creating a mechanized vegetable cleaning machine. By utilizing CAD tools and finite element analysis, the goal is to develop an advanced system that improves the cleaning process, reduces labour costs, and enhances the quality of the final product.

Design and fabrication of multiple root vegetable cleaning machine Sanjay Kumar SM, HR Vitala, BA Anand, and Naveen BV[3] From this paper a special machines is designed to clean different types of root vegetables.The machine is made with strong materials(stainless steel and food-safe plastic)that can withstand heavy use.The machine is tested to make sure it cleans the vegetables well, uses energy efficiently, and is safe to use.The goal of the machine is to make cleaning vegetables easier, faster, and safer, while also keeping the vegetables fresh and healthy.Totalefficiency achieved = 97.5%[4].The power from the motor is 186.5 watts and the torque is 111.7 Nm.It holds up to 20kgs of vegetables.

2.Introduction

Design and fabrication of a multiple root vegetable cleaning machine is a process of creating a device that can efficiently clean a variety of root vegetables, such as carrots, potatoes, and beets.

The purpose of this machine is to improve the efficiency and productivity of vegetable cleaning, particularly in commercial or industrial settings where large quantities of vegetables need to be processed quickly. The design of the machine involves identifying the key features and functions required for effective cleaning, such as water spray nozzles, scrubbing brushes, and adjustable settings for different types of vegetables. The fabrication process involves using materials such as stainless steel or food-grade plastic to create the framework and componentsand assembling them in a way that maximizes functionality and durability. The resulting machine should be able to handle a high volume of vegetableswhile providing thorough cleaning to ensure that they are free of dirt, debris, and other contaminants. This can help to improve food safety and hygiene, reduce waste, and increase overall efficiency in vegetable processing operations. The multiple root vegetable cleaning machine can be used in various settings, such as in commercial kitchens, food processing plants, and farms. Vegetables, including potatoes, carrots, beets, and turnips, among others. The machine uses a combination of water, brushes, and other cleaning agents to remove dirt, debris, and other contaminants from the vegetables. Root vegetables are a category of vegetables that are grown for their roots, tubers, or bulbs, which are the edible parts of the plant. They are known for their unique flavors, nutritional value, and versatility in cooking. Some of the most common types of root vegetables include carrots, potatoes, beets, turnips, radishes, onions, and sweet potatoes, among others.

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3.Methodology:

1. Stirrer-Type: A stirring mechanism is employed to create turbulence in the water, facilitating the cleaning of submerged crops. The agitation process may also involve the simultaneous movement of water and crops.

2. Roller-Brush Type: This design incorporates brushes attached to rollers, which provide a scrubbing action to remove impurities from surfaces under a steady flow of water.

3. Barrel/Drum-Type: Crops are cleaned within a rotating drum or barrel, where a continuous stream of high-pressure water effectively removes dirt and debris, resulting in reduced maintenance and operating costs.

4. Block Diagram

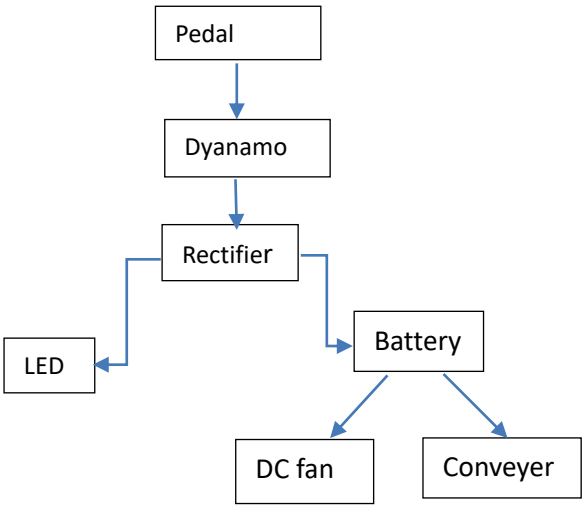

Figure1: Block diagram for Vegetable cleaning machine

5.Circuit diagram

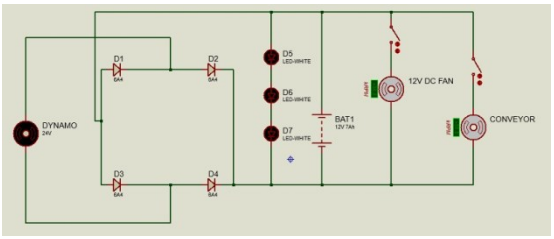

Figure2: Circuit diagram for Vegetable cleaning machine.

6.Hardware Components

6.1 DC Gear Motor

The 24V 150W DC Gear Motor is a suitable choice for a Vegetable Cleaning Machine, providing high torque at low speeds in figure.3. It can power a conveyor belt that transports vegetables through the cleaning process, drive brushes or spray nozzles that remove dirt and debrisor power a water pump that

Figure3:dc gear motor

supplies water to the cleaning system. The motor's compact design allows for easy integration into the machine, saving space and reducing overall size. Additionally, it operates quietly, reducing noise pollution and creating a more comfortable working environment. With its simple design and few moving parts, the motor is also easy to maintain and repair, reducing downtime and increasing overall efficiency. Overall, the 24V 150W DC Gear Motor is a reliable and efficient choice for Vegetable Cleaning Machines.

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6.2 Lead Acid Battery

The 12V, 7Ah Lead Acid Battery is a suitable power source for a Vegetable

Figure4:lead acid battery

Cleaning Machine, especially when combined with the 24V 150W DC Gear Motor in figure.4. Since the motor requires 24V, two batteries may be needed in series to achieve the required voltage. Lead Acid Batteries offer benefits like low upfront cost, well-established charging infrastructure, and reliable performance. However, they have limitations, including a relatively short cycle life, heavy and bulky design, and requirement for regular maintenance. To ensure optimal performance and longevity, proper charging and discharging procedures, storage in a cool dry place, and avoiding deep discharging are essential. Overall, the 12V, 7Ah Lead Acid Battery provides a reliable and cost-effective powersolution for the Vegetable Cleaning Machine.

6.3 Full-Wave Bridge Rectifier

The4-diodebridgerectifiercircuitisacrucialcomponentinthepedal-operatedvegetablecleaningmachine,enablingtheconversionofACtoDCpowerandmakingthemachine'soperationspossible in figure.5.

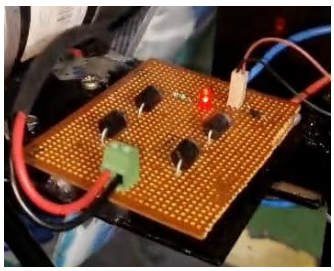

Figure5: Bridge circuit

6.4 DC Fan

The 12V DC Fan is a suitable choice for providing airflow to the conveyor belt in a Vegetable Cleaning Machine in figure.6. Its primary function is to dry the vegetables after washing, reduce moisture and prevent bacterial growth, and improve air circulation and ventilation. With its low power consumption, compact design,quiet operation, and easy installation and maintenance, the 12V DC Fan offers numerous benefits. When selecting a fan, consider factors such as airflow rate, static pressure, noise level, power consumption, and durability.By incorporating a 12V DC Fan into the Vegetable Cleaning Machine's conveyor belt system, you can improve the overall efficiency and effectiveness of the cleaning process.

Figure6:dc fan

6.5 Iron Drum with Net

In a Vegetable Cleaning Machine, the

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This cylindrical or drum-shaped container, made of iron or metal, is equipped with a net or mesh material that helps remove dirt, debris, and impurities from the vegetables in figure.7. As vegetables are loaded into the drum and rotate or tumble, water jets or sprayers clean them, while the net material prevents damage and improves water circulation anddrainage,ensuring clean and undamaged vegetables.

Figure7:drum

6.6 Conveyor Belt

The conveyor belt is a crucial component of the Vegetable Cleaning Machine, responsible for transporting vegetables through the cleaning process in figure.8. It's typically made of a durable, waterproof material such as PVC or rubber, with a smooth surface to prevent vegetables from getting stuck. The belt is designed to move at a controlled speed, allowing for efficient cleaning and processing of vegetables.

Figure8:vegetable cleaning machine

7.Working

The pedal-operated vegetable cleaning machine operates by harnessing human power to generate electricity and clean vegetables simultaneously. As the user pedals, the dynamo generates AC electricity, which is then converted to DC by the rectifier, charging the battery and powering the machine's components. At the same time, vegetables are cleaned in a metal chamber with high-pressure water sprinklers, using water from a 200-liter tank. After cleaning, the fan helps to dry the vegetables, and an LED indicates the machine's operational status. This innovative machine combines efficient energy generation with effective vegetable cleaning.

8 .Result Analysis

The vegetable cleaning machine integrates multiple components powered by a 12V, 7Ah lead-acid battery. The system is designed to perform two primary functions:

1. Cleaning using the motor-driven drum and water flow.

2. Drying using a DC fan.

Additional components like LEDs and diodes enhance usability and ensure safe operations.

The machine's design promotes reduced water consumption, improved vegetable quality, and increased productivity. Furthermore, the automated cleaning and drying process minimizes labor requirements, reducing operational costs. The machine's compact design and portability also make it ideal for use in

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various settings, from small-scale farms to large commercial kitchens.

8.1 Efficiency Analysis Steps

1.Input Power Analysis:
Identify power consumption for all electrical components:
24V DC Gear Motor: Calculate based on motor specifications
(current and power ratings).
12V DC Fan: Power = Voltage × Current.
LED Strip: Power = Voltage × Current.
2. Output Work:
Define the mechanical output (work done by the motor for rotation and fan for drying).
Consider any losses (e.g., friction in the drum or energy lost in non-essential components).
3. Loss Analysis:
Include electrical losses in wires, diodes (rectification loss), and inefficiency of components like the fan or LEDs.
Mechanical losses (friction in bearings, air drag from the fan, etc.).
4. Efficiency Calculation:
The efficiency is calculated as the ratio of useful work to input energy:
η=Input Energy Supplied/Useful Work Output×100

8.2 Efficiency Evaluation

This efficiency indicates that approximately 68.46% of the input energy is converted into useful work (cleaning, drying, lighting). The remaining 31.54% is lost due to: o Friction in the drum. Electrical losses in components like diodes and wiring. Air drag and inefficiencies in the fan and motor.

8.3 Power Consumption Analysis

Total Energy Available:
EBattery=84 Wh
The battery provides sufficient capacity for approximately 2 hours of operation.
Total Energy Consumed:
Etotal=130 Wh
Indicates that the system's components demand more energy than the battery's total capacity. If operated continuously, the battery may last less than 2 hours without recharging.

8.4Performance Metrics

Cleaning Efficiency:

Drum Rotation:
Powered by the 24V DC gear motor, achieves efficient cleaning action for rotating the drum.
Limitations:
Friction in the drum mechanism and iron stand can reduce performance.
Water Flow:
PVC pipes and valves enable effective water flow for cleaning vegetables.
Challenges:
Flow rate depends on water tank position and valve adjustment.
Drying Efficiency:
DC Fan:
Converts 50% of input energy into airflow, aiding in drying vegetables post wash.
Limitations:
Airflow direction and speed must be optimized to ensure even drying.

8.5Usability Enhancements:

LED Strips:
Ensure proper visibility during operation.
High energy efficiency (90%) minimizes power wastage.
Iron Drum with Net:

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Designed to retain vegetables while allowing water to drain efficiently.
Limitation: The material may rust over time without proper maintenance.

8.6 Design Strengths

1. Portability: Compact system with a self-contained power source.
2. Ease of Use: Simple ON/OFF switch operation.
3. Versatility: Can handle multiple cleaning and drying tasks.

8.7 Design Limitations

1. Battery Life: With energy demand exceeding battery capacity, extended usage without recharging is limited.
2. Energy Losses:
31.54% of energy is lost in conversion inefficiencies and friction.
3. Water Usage:
A 200L water tank may require frequent refilling for continuous operation.
4. Material Durability:
Iron drum and stand may be prone to rust without proper treatment.

8.8Suggestions for Improvement

1. Optimize Energy Usage:
Use higher-efficiency motors and fans to reduce power consumption.
2. Increase Battery Capacity:
Upgrade to a 12V, 10Ah or higher capacity battery to extend operating time.
3. Reduce Mechanical Losses:
Implement low-friction bearings and regularly lubricate moving parts.
4. Material Upgrade:
Replace iron components with stainless steel or aluminium to improve durability and reduce corrosion.
5. Add Solar Charging:
Incorporate a solar panel to recharge the battery, making the system more sustainable.

Figure9:carrot before washing and after washing

Figure10;sweet potato before washing and after washing.

9.Future scope

The vegetable cleaning machine will become more advanced with the help of embedded technology. Soon, sensors and tiny computers will be added to monitor and control the cleaning process in real-time. This technology will allow the machine to connect to the internet and work more efficiently. As it gets even smarter, the machine will be able to automatically adjust its cleaning settings and predict when it needs maintenance. It will even be able to see and remove dirt and contaminants more easily. With these advancements, the vegetable cleaning machine will become faster, more efficient, and more connected, making it easier to get clean vegetables**.**

10.Working analysis

Figure11: We put the vegetablesin drum

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Figure12:vegetables on conveyor belt

11.Conclusion

The pedal-operated vegetable cleaning machine is a remarkable achievement thatsuccessfullyharnesseshumanpowerand utilizesregenerativebraking.Thisinnovativedesignmakesitanefficientsolutionthateffectivelycleansvegetableswhileminimizingenergywaste.Bypromotingahealthierandmoresustainablelifestyle,themachineshowcasesthepotentialforhuman-poweredtechnologytohaveapositiveimpactontheenvironment.Overall,thepedal-operatedvegetablecleaningmachineisaperfectexampleofsustainableenergyharvesting,demonstratingthepossibilityofcombining,innovationandsustainability.

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