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A Review on the Development of Portable Device For Extraction of Green Leaves From Stem

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Abstract

This review paper explores the development of portable green leaf-separating machines that utilize the technology used in separating machines, while these machines can effectively separate leaves from unwanted materials. Manually separating green leaves from their stems remains labor-intensive and time-consuming. The paper addresses the technical, social, and economic challenges that must be overcome to develop green leaf-separating machines that are efficient, versatile, and cost-effective.

Keywords: Green Leaf Separating Machine, Agriculture Industry, Efficiency, Cost-effective.

Introduction

Green leaf-separating machines are a popular and efficient way to separate leaves from unwanted materials. These machines have revolutionized the industry, increasing production, higher quality, and more precise separation. Moreover, the machines developed for green leaf separation can also be utilized for other green leafy vegetables, making them versatile and practical for numerous applications. In India, green leafy vegetables are the second most important category of vegetables due to the country's climate, which provides opportunities for growing a wide variety of these vegetables. Green leafy vegetables are packed with essential minerals, vitamins, and dietary fiber and possess therapeutic properties, making them an ideal and intelligent way to fulfill nutritional requirements for good health and well-being.

Furthermore, with the onset of the COVID-19 pandemic, boosting the immune system has become crucial in preventing disease incidence. Therefore, the consumption of green leafy vegetables has become even more essential. India cultivates various greens throughout the year, including spinach, amaranth, fenugreek, gogu, drumstick leaves, and mint. These highly nutritious vegetables provide a rich source of vitamins A, C, E, and K while low in carbohydrates, sodium, and cholesterol. Additionally, they are excellent sources of phytochemicals, which aid in fighting against heart disease and cancer. Despite the high nutritional value of green leafy vegetables, their low consumption remains a significant issue due to the need for more knowledge among the public regarding

their nutritional benefits. Processing these vegetables for consumption can be labor-intensive and time-consuming, particularly when separating the leaves from their stems. To address this issue, green-leaf vegetable separation devices have been developed to improve efficiency and reduce waste. These machines have various advantages, including increased efficiency and reduced processing time, making them valuable to the agricultural and food processing industries.

Review of literature

1. **(Consorcio S. Namoco Jr. et al. 2022)** have designed a manually-operated mechanical vegetable chopper comprising a pusher assembly, blade assembly, and base assembly. The chopper is constructed using local and secondary food-grade materials, specifically stainless steel. The aim of the device is to overcome the challenges of time consumption, hygiene, contamination, and injuries associated with the manual process of chopping vegetables with a knife. The mechanical chopper saves time and effort in vegetable chopping, ensures safety for the users, and is eco-friendly due to its lack of electricity and noise emissions. In comparison to manual chopping with a knife, it demonstrates substantial time savings and produces uniformly chopped vegetables with better quality. This device is highly useful for households requiring fast, easy, and safe vegetable chopping, and is also suitable for mass production in food chains and restaurants.

2. (**Zhiquan Wang, Tianxing Yang ,et.al 2022**) propose a design and simulation of a flexible clamping and conveying device for a green leafy vegetable cutting and bundling machine. The goal is to enhance the efficiency of harvesting production for these types of vegetables and improve the overall performance of the cutting and bundling integrated machine, the paper utilizes theoretical calculations and 3D modeling to optimize the key components. The cutter head of the guillotine cutting and throwing device is a wheel cutter type with symmetrically distributed throwing blades and radially distributed movable blades positioned in between the two throwing blades. The electronic control system of the wrapping device employs a pressure sensor that works in conjunction with the baling device to enable automatic wrapping after baling. The drive chassis of the machine features a hydrostatic drive system that allows for step-less speed change and automatic control within a certain range. The results of the simulation study indicate that the proposed flexible clamping and conveying device can meet the industrialization needs of green leafy vegetables. This paper designs and simulates a flexible clamping and conveying device for a green leafy vegetable cutting and bundling integrated machine to improve the working efficiency of the device.

3. **(Agbonkhese, Kingsley A, Omoikholo Frank, et al. 2020)** designed and fabricated a leafy vegetable shredding machine. The economic importance, nutritional value, and viability of vegetables cannot be overemphasized. To add value to vegetables before domestic use, a motorized electric-driven machine was developed to avoid the challenges of time consumption, contamination, and injuries associated with manual vegetable shredding using a sharp knife. The machine comprises two rotor blades enclosed in the shredding unit, with vegetable leaves fed through the hopper (feeding unit) aided by gravity. The gear driver on the electric motor transmits motion to the gear on the rotor blades (driven gear) through an idler gear, enabling the rotor blades to drag the vegetable leaves in the opposite direction of rotation. With the assistance of the relative gear motion on the two rotor blades, shredding (cutting or sliding) of the vegetables is made possible. The machine is driven by a

1 HP electric motor at a speed of 1385 rpm, and the speed is reduced by the gear system when in operation. It has a good effect of shredding, long service life, reliable performance, is very portable, and able to add value for users.

4. **(Avesh, M., Siddul, Y.,et. al, 2021)** developed a low-cost leafy vegetable cutting machine by improving the performance of the conveyor. The machine is designed as a harvester for farming leafy vegetables such as lettuce, spinach, and baby leaf-types, where manual harvesting is a bottleneck process. Manual harvesting results in loss of time, money, and higher costs due to labor. Additionally, manual farming processes lead to more wastage of vegetables. To reduce wastage and save time and money, a harvester was designed for vegetable production. The harvester consists of a cutting blade that cuts the vegetable head at a perfect location, and then the cut vegetable is lifted into a container using a conveyor. A cutting equipment band saw belt is used, and the transport belt is driven by electric power. The harvester is manually operated, and there is a facility to adjust the cutter height according to the type of vegetable. The harvester works by moving forward, where wheels are provided for manual movement, cutting vegetables with a band saw blade cutter, and lifting leaves onto a conveyor belt. A 12V DC motor is used as a power source to drive the belt and cutter, and this motor is driven by a battery unit. The cut vegetables are transferred to the collecting box.

5. **(IKPOZA, E; USIOBAIFO, EJ; et.al 2021)** developed a design and fabrication for a manually operated vegetable leaf-slicing machine. The machine includes a hopper, cutter housing, cutting blades, a rotating shaft, and a wooden handle. Its purpose is to improve the hygienic slicing of vegetable leaf materials and prevent knife-related injuries for domestic and commercial use. The machine is securely bolted onto a flat platform using nuts and bolts. Vegetables are introduced by hand into the receiving compartment and pushed into the cutting compartment with the aid of the impeller through a cylindrical channel. The rotating stainless steel cutter blades slice the vegetables as they exit the cylindrical chamber into the cutting compartment. The handle is manually rotated to produce the rotary motion of the cutter blade, and the rotating shaft provides support and stability to the cutter. The desired cut size is achieved by adjusting the feed rate of the impeller.

6. **(Sushant Arvind Sonawane and Dr. Anil S. Maheshwari 2020)** developed an onion leaf-cutting machine, which is an important vegetable crop in India for both domestic consumption and as the highest foreign exchange earner among fruits and vegetables. The machine is composed of a cutter and belt conveyor assembly, which is mounted on the end side of the movable platform on the M.S. frame. The rotary cutters are positioned on the top side of the belt conveyor system. To operate the onion leaf cutter/remover, an onion is pushed onto the conveyor which moves forward. As the onion approaches the cutter, the electric cutter cuts the onion leaf. The belt conveyor system is supported by four pedestal bearings and operated using an electric gear motor. After the onion is cut, the leaf is separated and collected in a tray. This machine is semi-automatic, which means that the onion needs to be fed into the machine at specific intervals, resulting in a longer cutting time. Due to the simple structure of the support system, this model is easy to fabricate and has a low project cost.

Methodology

The green leaf vegetable separating machine is a specialized device that aims to separate leaves from the plant materials, such as stems and twigs. Its design is based on the separating machine, which is commonly used for plucking the leaves. This review paper will discuss the methodology used for designing the green leaf vegetable separating machine, which is based on the leafy vegetable shredding machine, onion leaf cutting machine, vegetable leaf slicing machine, etc.,

The materials used for the fabrication of the machine are:

Extraction unit

1. Stainless steel
2. Tool Dye
3. DC Motors
4. Step down transformer
5. Speed Controller
6. Fuse
7. Switch
8. Gear Drive
9. Thermal camera
10. Colour sensor

Packaging unit

1. Heater coil strip
2. Thermal insulation strip
3. Electric insulation strip
4. Hooper
5. Timer

Figure 1: Represent the block diagram of green leave separating machine.

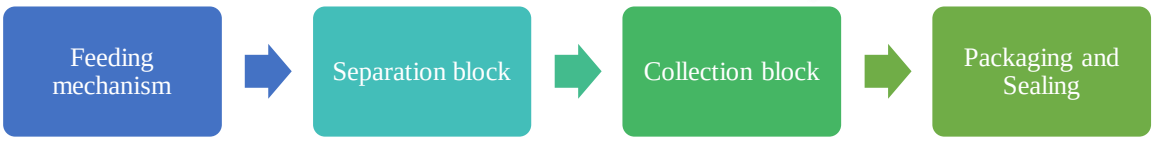

Figure 1: describes the leaf-separating machine is modified to suit the specific requirements of separating green leaves from other plant materials. This involves the incorporation of additional components, such as vibrating screens, air blowers, and conveyor belts. These components work in tandem to effectively separate the leaves from plant materials and deliver them to the collection hopper. The vibrating screens separate the larger materials, while

the air blowers remove the lighter materials, such as dust and small particles. The conveyor belts transport the leaves to the collection hopper while removing any remaining impurities.

Figure 2: Represents the flow diagram of the green leaf-separating machine

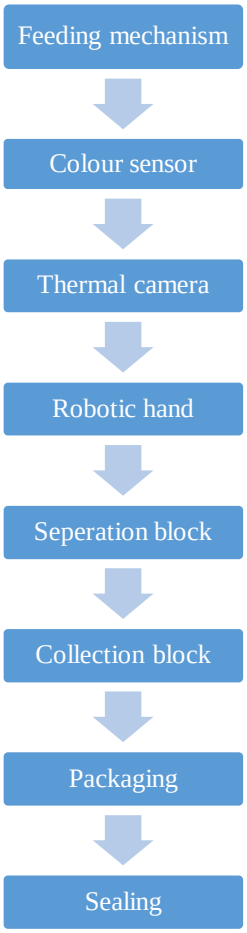

Figure 2 describes the process that involves inserting green leaves into the machine and using the tool to separate them. The separated leaves are then transported by the conveyor. Any defective leaves are detected and separated by a color sensor, while insect-affected leaves are identified and removed by robotic hands equipped with a thermal camera. The good leaves are collected in the separation block and transferred to the collection block. In this block, the collected leaves are packed into plastic bags and sealed.

Conclusion

The development of green leaf-separating machines presents an opportunity to revolutionize the agricultural and food processing industries by improving efficiency and reducing waste. Using leaf-separating machines as a starting point for design allows for tailored solutions that can handle the specific needs of various green leafy vegetables. However, addressing technical, social, and economic challenges is crucial for the success and sustainability of these machines. Through research and optimization of parameters, such as vibration frequency, amplitude, and air velocity, and utilizing machine learning algorithms, the development of green leaf-separating machines can be a game changer for the industry.

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