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Fabrication of Tea Leaf Cutting Machine Operated on Solar Energy.

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Abstract: One of the most popular and one of the most affordable drinks in India is tea. Tea has been cultivated in India for a very long time, and it has been used in traditional medical practices across the country, in addition to being consumed. With hundreds of years of experience, India has been producing and eating it. While China is the world's greatest producer of tea, India is the world's second largest producer of tea. One of the companies with the highest consumption. In order to produce tea, the leaves are harvested and processed in factories. The leaves are then evaluated according to their quality, with different grades belonging to different categories. In addition to the bud, the two leaves that accompany it are of the highest grade. As a result of the significant challenges that the tea sector in India is confronted with, such as a lack of available workers, a decline in salaries, and the presence of pests, the output rate has decreased. This led to the use of automation in the tea leaf harvesting process.

For the purpose of enhancing tea output via the use of cutting-edge technology, a tea leaves harvesting machine will play a significant role in terms of its contribution. This project provides a concise overview of the approaches that are already in use and also suggests a new model that can be used to address the shortcomings of the mechanisms that are currently in use.

Keywords*: Exhaust gas recovery, waste heat recovery, I.C Engine fuel economy, TEG Elements (Thermo electric Generator), Harnessing waste heat*

Introduction

The process of harvesting tea is a highly laborious one that calls for a lot of effort and dedication in order to get the maximum amount of quality from the plant. Either by hand or with the assistance of machines, tea leaves are being harvested. The goal is to cut down on the expenses associated with harvesting while maintaining the high quality of the tea leaves throughout the process. As a result, it is essential to have a computer that is lightweight, user-friendly, and portable. There are a number of limitations associated with the tea leaf harvesting devices that are now in use, and the purpose of this project is to address some of those issues and to provide a new way that will make leaf gathering simpler.

HISTORY OF MECHANIZATION OF TEA LEAF HARVESTING:

In spite of the fact that the majority of tea is harvested by hand, there has been a growing interest in alternate harvesting techniques for nearly as long as the tea business has been. Kilgore cites the usage of the Swinburne copper in Assam in 1887 and shears in Japan in the 1990s as examples of how tea growers have been investigating the possibility of mechanizing the harvesting process because to increased production costs and concerns about a lack of available labor and human resources. The majority of the field activities, including plucking, have already been automated in Japan and Argentina. However, the tea industries of southern Africa continue to depend mostly on human labor for picking. This is despite the fact that the use of automated harvesting is becoming more commonplace in some nations where physical labor is not only in limited supply but also becoming more costly. Large estates and out growers in South Africa and Zimbabwe are now harvesting all of their tea, or a significant part of it, using mechanized harvesting methods.

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Literature Review

MECHANICAL HARVESTING OF TEA IN SOUTH AND CENTRAL AFRICA;

MARTIN

In the early 1970s, Argentina was the first country among the member nations of the Tea Research Foundation of Central Africa to begin utilizing machines for harvesting tea. This was due to a scarcity of labor, which led to the mechanization of tea harvesting. South Africa was the first country among these countries to begin employing machines. Considering that the tea harvesting machine is still in its infancy in the majority of the area, simpler kinds of equipment were used until recently.

For the sake of cutting costs, the majority of the estates experimented with shear plucking. The majority of people have decided to prohibit this since the production was not as high as anticipated and the bushes were destroyed. In the majority of the estates, hand-held equipment were

used because of their ability to work effectively in mountainous terrain. Single- or double-man operated machinery were used for these equipment. Later on, machines with wheels that were driven by two or four stroke engines and operated by three or four persons were introduced. The sizes of these devices range from 1.2 meters to 2.4 meters. In general, machines with four wheels have more control over keeping the height of the bush than machines with two wheels, which have a propensity to tilt throughout the process of maintaining the height of the bush. When operated by a single individual, the devices have the capacity to produce 350 kg of green leaves.

TEA LEAF HARVESTING AN ANCIENT ART FORM: STEVE GREENS

The distinctive taste of the tea is a result of the subtropical environment, which is characterized by a certain amount of rain and sun, as well as rocky terrains and acidic sand. For the sake of maintaining the leaves' integrity prior to harvesting, the picking of the tea must be done by hand. Collecting leaves by hand includes doing it in a way that does not cause damage to the stem.

The use of a machine will result in a decrease in the quality of the tea since it will increase the quantity of brushing and the number of stems that are included in the harvest. There is a thirty-foot range that tea brushes can reach. Because of this, harvesting is made more difficult. When it comes to tea farming, the height of the bushes is kept at a reasonable height so that the leaves and buds may be picked with ease. The plants are trained to produce leaves that are closely packed around the region that can be readily accessed by hand via the process of pruning them at comfortable heights on a regular basis. The harvesting of tea takes a sharp eye and a quick hand to do successfully. Tea may be produced from a single plant that can provide up to one pound of tea.

COMMERCIAL CROP TECHNOLOGY: VOL08 HORTICULTURE

SCIENCE: ALICE KURIAN

In order to cut down on the amount of labor that is required during the plucking process, countries like as Japan and Russia have begun using mechanized harvesting. It is now being attempted by India as well. A specific cropping pattern may be seen in South India, which has periods of heavy cropping followed by periods of low cropping. When it comes to collecting tea, one of the most significant challenges is the lack of available laborers in sufficient numbers. To a certain degree, this issue may be resolved with the assistance of integrating harvesting equipment into agricultural operations.

Reduced man hours are achieved by the use of mechanical harvesting. For the purpose of collecting leaves and ensuring that the bags are stored correctly, these devices need an extra person. When opposed to the 25–40 kilograms that are harvested by hand, the yield of automated harvesting is 1000 kilograms per hour. Harvesting by machine is not possible in sections that are tightly spaced together.

Over the course of five years, the tea leaves of the new tea plant will be ready for harvesting. Throughout the course of the year, the plant does not grow in a consistent manner. There is a significant relationship between the environment in which the plant is developing and the amount of new buds and leaves that are produced by the plant, as well as the number of harvests that are produced.

In some regions, there is a time of dormancy during the winter and a growth season for tea. The majority of harvesting is done by women, and each day, they are assigned a quota or a certain number of leaves to pick. The harvesting of an expert picker is equivalent to thirty kg per day. Since only the bud and the top two leaves are taken from the tea leaves, it is advised that the leaves be picked by hand. A blade is the section of a tool, weapon, or machine that has an edge that is meant to pierce, cut, slice, or scrape surfaces or materials. Blades may also be used instead of blades. A flaking stone, such as flint, metal (often steel), ceramic, or any other substance have the potential to be used in the production of a blade.

Blades, which are among the oldest tools in human history, are still used for a variety of functions, including self-defense, food preparation, and other activities.

TEA HARVESTING IN DIFFERENT PART OF THE WORLD: FRANCIS

XAVIER DELMAS

Rather of cultivating tea on their own property, individual framers in South Sri Lanka sell the tea after it has been harvested since they lack the equipment necessary to process the tea. These will be sold to the companies in the surrounding area. Because it is easier for rainwater to escape from an inclined surface, it is a good location for the cultivation of tea. In areas that are relatively flat, it is important to maintain drainage systems in order to cultivate healthy bushes. In the majority of the area, women are the only ones who pick tea, while men are the ones who do other duties.

COFFEE, TEA AND COCOA: AN ECONOMIC AND POLITICAL

ANALYSIS: VERNON DALE WILDZER

Shears were used in the harvesting process in Japan, and the tea bushes were kept as beautiful plants. This allows for meticulous selection to be made, provided that the plucking is done by hand. There has been an increase in the production per person as a result of the introduction of shears; nevertheless, there is less control over the quality.

As the cost of labor continues to rise, tea picking has become more mechanized. Both the fineness and coarseness of the plucking are determined by the quantity of leaves that are picked and the amount of time that is allowed in between each round of plucking.

FACTORS IN ERGONOMIC HAND TOOL DESIGN: SARAH

Handle design has a significant impact on both the efficiency and safety of all kinds of tasks that people do on a daily basis. The diameter of the handle need to be sufficiently thick to allow the finger tips to be separated from the palm. The length of the handle should be between 10 and 15 centimeters, and the diameter should be between 3 and 4 centimetres.

METHODOLOGY

The tea shrub that is being harvested mechanically, which includes procedures such as plucking rounds, table height raise, and trimming cycles. It has been noted that certain estates see a decrease in yield when plucking machines are employed throughout more than one season; this is something that needs to be explored. Evaluating the quality of the leaves obtained by mechanical plucking is also necessary. When compared to human hand plucking, there is some evidence to suggest that mechanical plucking results in a larger number of maintenance and immature shoots being plucked. Although there is evidence that the proportion of primary grades produced has decreased, there is a possibility that the fiber content will grow.

PRODUCT STUDY:

Figure 1. product Study

The harvesting of tea leaves may be done either manually or by machine. The term "tea leaf harvesting machine" refers to a piece of machinery that facilitates the harvesting of tea leaves with a reduced number of human laborers. Once again, manual harvesting may be broken down into two categories: hand plucking and plucking with the use of trimming scissors. There are two categories of machines: those that are powered by gasoline or petrol and those that are powered by batteries. Cutter, blower, and a two-stroke engine are the primary components of a tea leaf harvesting equipment that is powered by petrol or gas. Collection bag is also an essential component. A collecting bag, a dc motor, a battery, and a cutter are the components that make up a harvesting machine that is powered by a battery. The flap is used to move the leaves into the backpack.

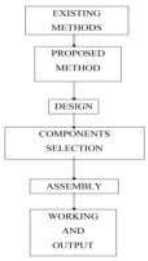
Figure 2 .Product study

The harvesting capacity of the equipment that is powered by fuel is 900 kg per day. The mechanism takes up about 17 kg of weight. A 12 volt and 7.5 ampere-hour battery serves as the source of power for a machine that is powered by batteries. The dc motor that is attached to it is able to spin since it is powered by the power produced by the battery. Through the use of bevel gears, it is possible to accomplish the rotational motion of the motor from the horizontal direction to the vertical direction. It is the blades that are revolving at a high speed that are responsible for cutting the leaves. When the bag is full, the metal plate that is linked to the axis of the blade is responsible for transferring the leaves that have been chopped into the sack attached. When the bag is full, the metal plate is changed with a new bag.

PROBLEM STATEMENT

In the process of harvesting tea leaves, the objective of this research is to provide an alternative methodology for the use of automation. As a result of the primary criterion being increased productivity in conjunction with less labor and time, and therefore increased profit. The purpose of this report is to do a case study of the tea harvesting machine that is currently in use, provide a solution to the issues that have been identified, suggest a new design, conduct a feasibility analysis of the design and fabrication of the machine, and conduct testing on the machine.

BLOCK DIAGRAM



ENGINEERING DESIGN

There is a wide variety of tools available in Creo Elements/Pro that make it possible to generate a comprehensive digital representation of the product that is being developed. There is the capability to develop geometry of additional integrated design disciplines, such as industrial and standard pipe work, as well as comprehensive wire specifications, in addition to the general geometry tools that are available. There are various tools available to help the creation of collaborative projects. There are a variety of concept design tools that may be used in the subsequent process of engineering the product. These tools supply ideas for industrial design at the beginning of the process. Conceptual drawings for industrial design, reverse engineering using point cloud data, and extensive freeform surface tools are some examples of these.

COMPONENTS AND DESCRIPTION

The following is a description of the primary components that are used in an efficient manner throughout the procedure of designing and fabricating the solar-powered tea leaf cutting machine:

- Battery.
- Motor.
- Solar panel.
- Frame.
- Cam mechanism.
- Blower.
- Cutting jaw.

MANUFACTURING PROCESS

Fabrication is converting raw materials into final products for many applications. A multitude of procedures is involved in the manufacture. These solid-state manufacturing technologies include little material wastage. This stabilizes temperature and applies significant force, causing the material to flow and assume the desired form. The desired form is regulated using a series of tools and dies, which may be closed throughout the manufacturing process. These procedures are often used for high-volume manufacturing rates. These are often cost-effective and often enhance the mechanical qualities. These are fabrication procedures in which the initial raw materials are generated by one of the preceding manufacturing processes. 4.1. FLEXURE During the bending operation, the material, in the shape of a flat sheet or strip, is evenly deformed along a linear axis that resides in the neutral plane and is perpendicular to the longitudinal direction of the sheet or metal. This industrial method creates a V-shape, U-shape, or channel form along a linear axis in ductile materials, primarily sheet metals. Frequently used apparatus encompasses box and pan brakes, brake presses, and several specialist machine presses. Common objects manufactured in this manner include boxes, such as electrical enclosures and rectangular ducting.

WELDING

Welding is a method of uniting two metal components by the use of heat. Welding is the most economical technology and is extensively used in manufacturing today. Welding joints of various metals via many procedures that provide heat either electrically or using a gas torch. Various welding techniques are used in the fabrication of automobile bodywork, structural components, tanks, and general machinery repairs. Welding is used in refineries and pipeline manufacturing within several sectors. It may be referred to as a secondary manufacturing process. Arc welding is a procedure used to combine metals by using electricity to generate sufficient heat to melt the metal, which, upon cooling, results in the binding of the metals. A specific form of welding employs a power source to generate an electric arc between a metal electrode and the base material, facilitating the melting of metals at the point of contact. It utilizes either direct or alternating current, together with consumable or non-consumable electrodes. The procedure may be manual, semi-automated, or totally automatic. The procedure is very adaptable, requiring little operational training and affordable equipment; hence, arc welding is used for the welding of frames and grippers.

DRILLING

Drilling is a machining operation that employs a drill bit to create a circular hole in solid materials. The drill bit is often a rotary cutting instrument, frequently including many points. The bit is applied to the workpiece and turned at speeds ranging from hundreds to thousands of revolutions per minute. This compels the cutting edge to engage with the workpiece, severing chips from the hole during the drilling process. The hole is often not created with a circular cutting action, but the bit is generally rotated.

GRINDING

Grinding is an abrasive machining method that utilizes a grinding wheel as the cutting tool. It may provide very refined finishes and precise dimensions. In mass manufacturing environments, it can efficiently process substantial quantities of metal in a short time. It is often more appropriate for the milling of very hard materials than conventional machining. Grinding is a subset of cutting, since it constitutes a genuine metal cutting process. Each abrasive grain functions as a microscopic cutting edge, shearing a minuscule chip analogous to what is generally referred to as a cut chip. Grinding is a kind of cutting, since it constitutes a genuine metal-cutting process. Each abrasive grain operates as a miniscule single-point cutting edge, severing a minuscule chip comparable to what is traditionally referred to as a "cut" chip.

WORKING PRINCIPLE

The experimental configuration of our project comprises a framework onto which the stationary jaw and the moving jaw are affixed. The cam mechanism and motor facilitate the action of the moveable jaw. The motor is powered by a battery. A blower is positioned at the side of the machine to dislodge leaves trapped between the jaws. A different backpack configuration is established, including a solar panel and a backpack. The backpack is designed to support the solar apparatus for transport by the user. The operator transports the backpack in conjunction with the solar panel. The solar panel converts solar energy directly into electrical energy, which is stored in the battery. The battery provides energy to the motor. The motor's power is conveyed to the cutting jaw via a cam mechanism. The cam mechanism converts rotational motion into linear motion. The moveable jaws operate, trapping the leaves between the fixed and mobile jaws, resulting in their severance.

DESIGN

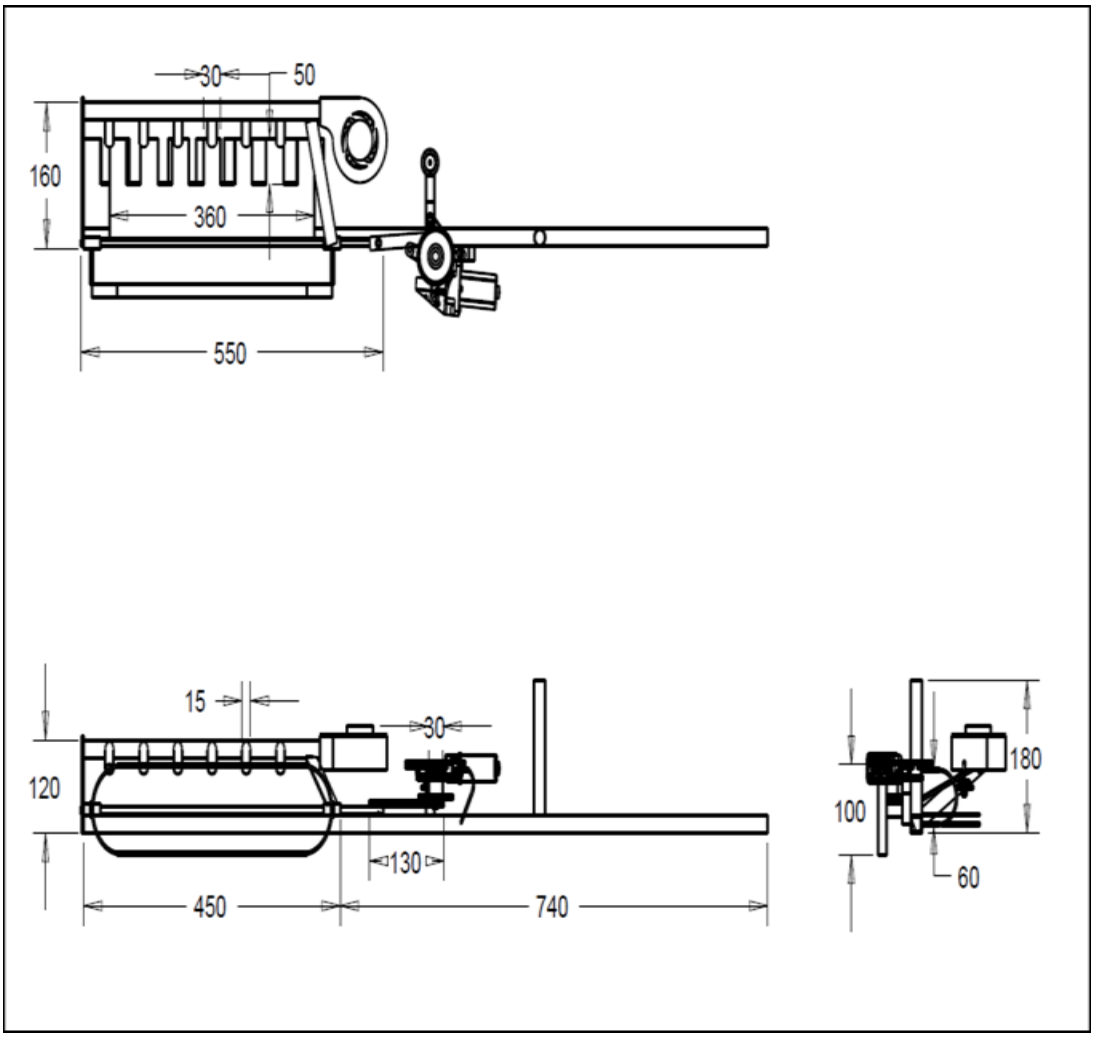


Fig-. 2D Drawing

Table-1. List of materials

LIST OF MATERIALS Sl. No.	PARTS	Qty.	Material
1	Frame	1	MS
2	Solar panel	1	Silicon
3	Battery	1	Lead acid
4	Blower	1	-
5	Motor	1	DC
6	Cutting jaw	1	MS
7	Cam mechanism	1	MS

Table 2: Cost estimation

Cost Estimation Sl. No.	Parts	Qty.	Amount(Rs)
1	Frame	1	800
2	Solar panel	1	2500
3	Battery	1	1400
4	Blower	1	900
5	Motor	1	1400
6	Cutting Jaw	1	900
7	Cam Mechanism	1	1700
8	Other expenses	1	1300
Total		10900	

Conclusion

This project has given us an exceptional chance and experience to use our limited expertise. We acquired substantial practical expertise in planning, procurement, assembly, and machining throughout this project. We believe that the project work effectively connects the institution with the industry. We take pride in having successfully finished the task within the constrained timeframe. The design and fabrication of the solar-powered tea leaf cutting machine is operating under excellent circumstances. We can comprehend the challenges in maintaining tolerances and ensuring quality. We have used our abilities and skills to the fullest extent, making optimal use of available resources. In the concluding notes of our project, we will provide more commentary about our impressions of the work undertaken. Consequently, we have created a "SOLAR POWERED TEA LEAF CUTTING MACHINE" that facilitates efficient leaf cutting in a reduced timeframe, using a simple mechanism and at a minimal cost. Utilizing additional methodologies allows for modification and development tailored to specific purposes.

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