

Automation of Coconut Broom Packaging from Coconut Leaves

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Abstract- *In this computerized world, every process or industry is getting automated with the advancement in science and technology for the effective outcomes along with reduced man power, running cost, running time and increased productivity. Cleanliness is one of the most important things of human values. All human try to clean themselves in one or another way. The broom made up of coconut leaves is one of the most common things used for cleaning purposes all over the country. In the process of making coconut broom, the people are used to separate the mid ribs from coconut leaves and to tie them into broom stick manually which takes lot of time. The project automates the process of making broom from the coconut leaves in order to reduce the time consumption and increase the productivity.. The whole process is sequenced and controlled by special form of microprocessor based controller called Programmable Logic Controller (PLC). The waste product of the process i.e., soft leaf mass is used as the food for herbivorous animals such as cows, sheep, horses, etc., The system also provides an opportunity to establish small scale industries by farmers and increases their income and hence improves the society.*

Keywords:- PLC, Coconut broom, Load cell

I. INTRODUCTION

Coconut plantations and processing industries provide income to the farmers and employment to rural population. Coconut is the most popular palm grown in about 90 countries of the world occupying about 10 million hectares of land and producing nearly 42 billion of nuts per year. In India there is 1.514 million hectares of land under coconut from where 9.7 billion nuts are produced annually. In addition to that, the other parts of the coconut trees are used for various applications. A famous Turkish proverb goes: ‘You can tell a lion from where he dwells’. Meaning: A person’s character shows itself from his surroundings. With the development of new technologies, cleaning has become easier when compared to the past. However, in some places where technology is unavailable or deficient, the traditional methods are still widely used. One of the cleaning processes that are used is sweeping and the preferred implement is still the broom. Along with vacuum cleaners and brooms or brushes that have a lot of parts derived from hydrocarbons, brooms from natural

sources are commonly used. The stiff midribs of the coconut leaves are used to make skewers, kindling and arrows. Bound together, the leaves can also be fashioned into brooms and brushes that can be used for cleaning purpose, making basket, mask, etc. Even in this hasty world, all these process are done labor-intensive only which take a lot of time.

II. OBJECTIVE

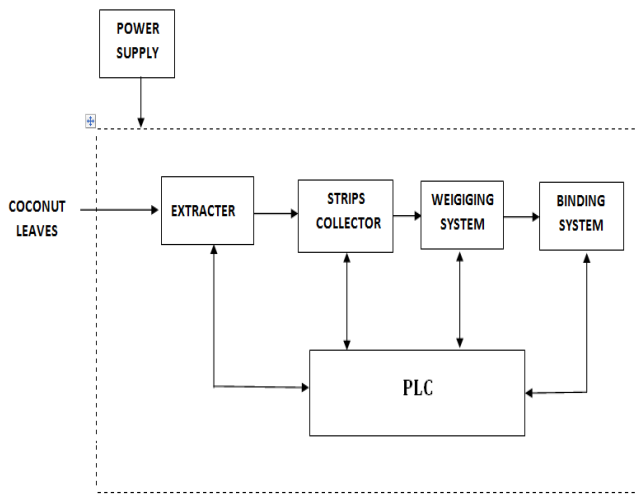
The objective of the project is to replace the existing system in which people are used to make the coconut broom stick by unscrambling the mid ribs from the coconut leaves one by one with the help of knife and combining the group of mid ribs into the broom. The size and weight of the broom varies from each other due to the manual process. The time required to make a broom completely is dependent on the efficiency of the individual. The system having the electromechanical system is implemented to separate the mid ribs from the leaves and bound them into broom stick in automated manner. And thus uniform weighted brooms are manufacturing at the constant rate with increased productivity and decreased man power.

III. METHODOLOGY

The coconut leaves are removed from the trunk and fed to the extractor through the input feeding roller. Following that the mechanically crushing rollers are arranged in such a way to extract the mid ribs from the leaves by crushing them. The detached mid ribs and crushed soft leaf mass are collected separately. The conveyor system is used to collect the separated mid ribs from crushing system for packing them into the broom. The load cell that measures force or load acting on it is used to measure the weight of mid ribs in order to maintain the uniform weight for the brooms. The output of the load cell i.e., change in resistance is converted to the change in voltage with suitable signal conditioning unit. Then the comparator compares the output voltage with the predefined voltage level equivalent to the required weight. If the required weight is obtained the packaging system bind them together with special type of thread. The overall process is sequenced by Programmable Logic Controller which is capable of processing both analog and digital data. It controls the functions of the crusher, conveyor motors, load cell and

packaging system based on the ladder logic diagram stored in the device.

BLOCK DIAGRAM



BLOCK DIAGRAM DESCRIPTION

The overall block diagram of the system is shown in the fig 4.1. It represents the process flow through various stages. The brown lines in the fig indicate the control lines from PLC and the power lines for all the devices. The blue lines indicate the process flow from raw material to final product through various stages

Extractor

It is the first and main part of the system. The detached coconut leaves from the trunk is used as the raw material which enters the extractor through the input feeding roller. The working of the extractor is similar to the sugarcane crushing machine. The extractor consists of special form of roller arranged in such a way that they are rotated in opposite direction to allow the coconut leaves to pass through them. The gear system is used for driving both the rollers with a single motor. The rollers are designed in a threaded manner to crush the leaves without damaging the mid ribs. The rollers are driven by electrical motor and controlled by PLC. This part removes the mid ribs and soft leaf mass which is collected and used for the food for herbivorous animals.

Strips Collector

The purpose of this strip collector is to collect the detached mid ribs from the extractor and remove the waste leaf mass if any presents. This includes interconnected spaced rollers and conveyor system. Low power DC or Stepper motor is used for driving the conveyor system which is commanded by PLC.

Weighing System

The Load Cell place a major role in the weighing system. The load cell used is either a capacitive load cell or a resistive load cell. The weighing system is responsible for producing brooms with uniform weight. The suitable signal conditioning unit is used to convert the output of load cell into electronic form capable of processing by PLC. The PLC sets the set point of electronic signal equivalent to the predefined weight of the individual broom. The weighing system collects the mid ribs from the strips collector until the output of the signal conditioning unit is equal to the set point set by the PLC. After the set point is reached the collected group of midribs is forwarded to binding system.

Binding System

The binding system receives the group of mid ribs from the weighing system with the uniform weight. The packaging system is in ideal condition until it receives the control signal from the PLC which commands the system to pack the input from the weighing system after the output of the signal conditioning unit reaches the set point. The packaging system uses the special type of thread for packaging. The thread selected for packaging is selected in such a way that it is able to tie the mid ribs tightly. The packaging system uses the knotting methods in such a way that it allows the users to reduce the diameter of the thread based on the user's convenience. There is an indicating system to instruct the operator to replace the thread foil.

PLC

Programmable Logic Controller is the heart of the project. It sequences the operations of each sub systems and switches them to ideal state when no operation takes place. It starts the conveyor motor only after the output from the extractor is obtained. The set point for the weight of the individual broom is also set by PLC. The analog PLC is used rather than the digital PLC because of processing the analog signal from the signal conditioning unit whose output is proportional to the weight of the mid ribs. The PLC receives from the sensors, processes the inputs based on the LLD downloaded to them and produces the output on motors and indicating LEDs.

Power Supply

A power supply is an electronic device that supplies electric energy to an electrical load. The primary function of a power supply is to convert one form of electrical energy to another and, as a result, power supplies are sometimes referred

to as electric power converters. Some power supplies are discrete, stand-alone devices, whereas others are built into larger devices along with their loads. It supplies the required power for motors used in extractor and conveyor systems, weighing system and packaging tools.

IV. WORKING

Initially the raw coconut leaves are given to the extractor. The extractor is a mechanical device used to crush the leaves to remove the unwanted parts, the remaining mid rib are collected in the conveyor system which transform the mid rib to weighing channel. The weighing system is digital lode cell used to set the requested weight of the broom. The whole system is operated and controlled by a single plc named as OMRON HL series. In the system DC motor is used to rotate the extractor and conveyor.

V. CONCLUSIONS

This paper enables automation of making broom from the coconut leaves. The threaded roller along with motor driver automates the process of extracting mid ribs from coconut leaves. And the load cell based weighing system is used to maintain the weight of the brooms at constant level. The broom stick is packed from the group of uniform weighted mid ribs with the help of special type of thread. The major advantage is to reduce the time required for making broom from coconut leaves. The system also reduces man power and increases productivity with constant rate. It also provides an opportunity for farmers to establish small scale industry. It can also be provided with low cost in future for regular purpose in the country and thus develops our society.

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