AUTOMATIC SUGARCANE NODE CUTTING MACHINE

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ABSTRACT

Sugarcane (Saccharum sp.) is a clonally propagated grass of the Gramineae family characterized by a high degree of polyploidy and is a crop of major importance providing about 65% of the world sugar. Reproductive tissue is harvested as the economic product in nearly all field crops but this is not the case in sugarcane. In sugarcane, the stalks are the harvested tissue and stalk size has a major influence on yield. There has been virtually some research reported on the variation in size of individual stalk internodes with position on the stalk and with crop growth.

Sugarcane planting with traditional methods is costly, time-consuming and necessary compression of buds in the field is not achieved easily because of stalk planting in sugarcane. In tradition planting method, great human force and high volume of sugarcane stalk in hectare is required. To solve this problem and mechanizing of sugarcane planting, we suggest the application of machine vision system and image processing methods to identify nodes from sugarcane and to plant it.

I INTRODUCTION

India is a country which is dependent on Farming as a main source of income for many families. Farmers are thus primly important for us. In India agriculture has facing serious challenges like scarcity of agricultural labour, not only in peak working seasons but also in normal time. This is mainly for increased nonfarm job opportunities having higher wage, migration of labour force to cities and low status of agricultural labours in the society. Sugarcane is the world's largest crop 2010 Food Agricultural Organization (FAO) estimates it was cultivated on about 23.8 million hectares in more than 90 countries, with a worldwide harvest of 1.69 billion tons. Brazil was the largest producer of sugarcane in the world and India in second position. In our state i.e. Maharashtra, crops like Rice, Wheat, Sugarcane grow in majority. Sugarcanes are important part of it. Nearly 35 to 45 % of field is under Sugarcane only. Thus it is mostly needed to be focused on it. Mechanical properties of the sugarcane stalks are to be considered in the development of a sugarcane combine harvester. The design of

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the major unit operations such as de-topping, base cutting with de-trashing and conveyance are depends upon the above properties.

In sugarcane agriculture, planting methods are based on slope and soil condition of land, wind direction, availability of water, etc. Normally sugarcane is planted by ridge and furrows method by using three eyed (budded) sets. For this method 3.5 to 4 MT seed is required per hectare

It is easy for management and gives high yield. It uses two eyed sets and planting is done by keeping 4 to 6 cm distance between two sets. This type of planting needs 2 to 2.5 MT seed per hectare. In Spaced Transplanting (STP) method single eyed sets are used for planting. In this method sets are directly grown in field or grown in polythene bags in nurseries that are transplanted into the field after 50 to 55 days from the date of plantation. The STP method needs 750 kg to 1MT seed per hectare is required, which saves seed.

Sugarcane planting with traditional method is costly, time-consuming, requires great human force and high volume of sugarcane stalk per hectares. Now a days sugarcane planting machines are used to reduce the human force and time. However, these machines do not have control on cutting location. In uncontrolled cutting process 3 to 6 buds set may get planted instead of single bud.

In addition to proper controlled cutting of stalk, it is necessary to identify any disease in the node as it affects the yield and quality of the sugarcane. Unfortunately the traditional sugarcane planting machines do not have any such facility.

Available Techniques:

- Nowadays mostly farmers cut the nodes by using '***Koyata***'.
- Some farmers use **machine saws** but it is risky.

II BLOCK DIAGRAM

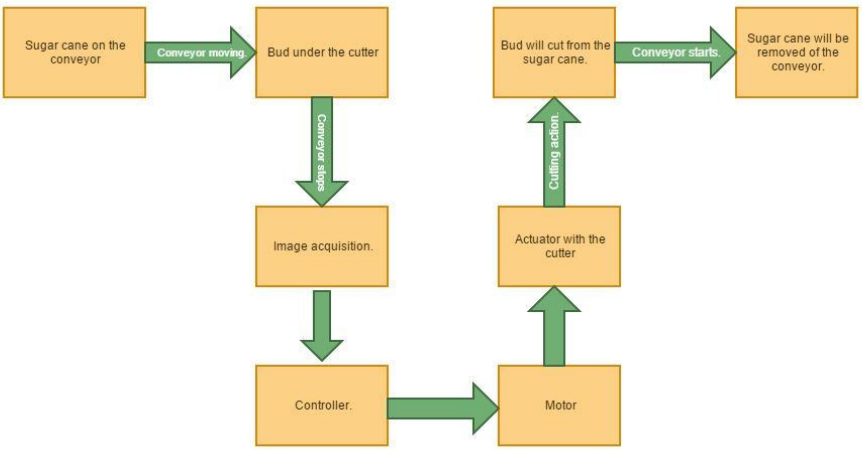

Fig. Block Diagram of Working

In the above figure there are five main components are shown. These are arranged in order as shown in figure. In this device we are using imaging technology for detecting the nodes of the sugarcane. Therefore for that purpose we are using image capturing device i.e. a camera. Then camera will be connected to the microprocessor. Then microprocessor will be connected to the prime mover. Blade is connected to the prime mover (hydraulic cylinder).

As mentioned earlier we are using imaging technology for detecting nodes of the sugarcane for that programming should be carried out. For programming purpose we are going to use a MATLAB. After programming we can detect a node. First of all camera will take photos of the sugarcane then it will send to the microprocessor where that image will processed and nodes will be detected. Then microprocessor will give a signal to the prime mover. Prime mover actuates the blade and will cut the sugarcane in the predetermined length.

In the above figure there are five main components are shown.

- Image capturing device.(camera)
- Microprocessor.
- Prime mover (hydraulic cylinder or electric motor)
- Cutting blade
- Cutting platform

III CONSTRUCTIONAL DETAILS

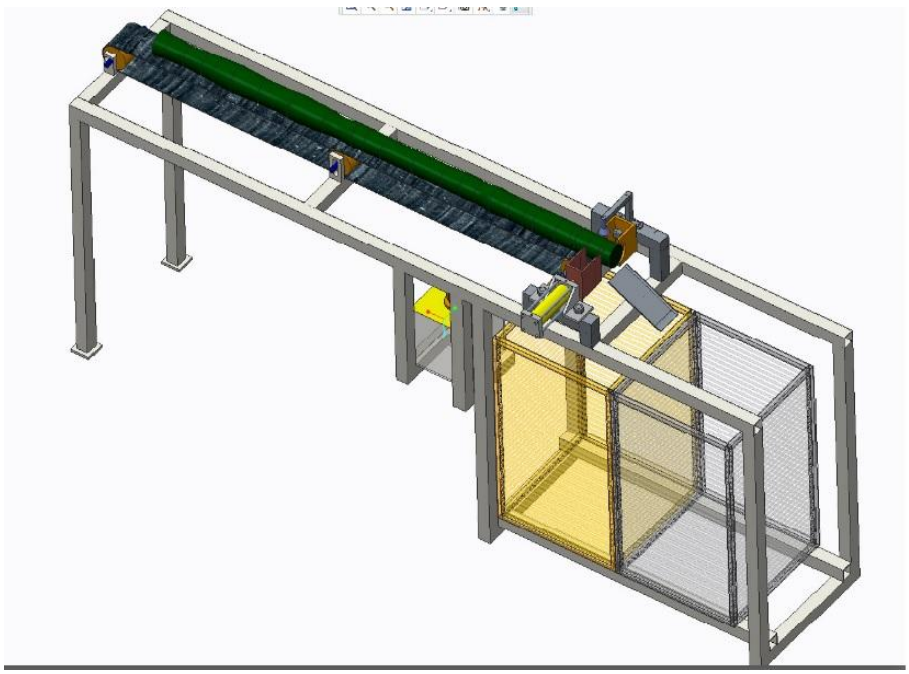

Fig. Actual sugarcane node cutting machine

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Sugarcane which placed on conveyor is moved over conveyor by rotating the conveyor system. The node of sugarcane is sensed by camera (Which is attached at the end of conveyor). By the image processing principle, electronic controller senses the image and compares it with reference image. When the node is present, controller sent the signal to actuator to cut the node. Cutting is carried by using linear actuator. Pneumatically operated linear actuator is made with the cutter at the end, cuts the node. The node cut by cutter is carried by collector. If node is not present (or defected node) is not sensed by camera, so no cutting operation is carried, it is forwarded to another collector.

IV EQUIPMENT REQUIRED

4.1. Cutting Blade

A blade is the portion of a tool weapon or machine, or with an edge that is designed to puncture, chop, slice or scrape surfaces or materials. A blade may be made from a flaking stone, such as flint metal (usually steel), ceramic, or other material. Blades are one of humanity's oldest tools, and continue to be used for combat, food preparation and other purposes

4.2. Piston

A piston is a component of reciprocating engines, reciprocating pumps, gas compressors and pneumatic cylinders among other similar mechanisms. It is the moving component that is contained by a cylinder and is made gas-tight by piston rings In an engine, its purpose is to transfer force from expanding gas in the cylinder to the crankshaft via a piston rod and/or connecting rod. In a pump, the function is reversed and force is transferred from the crankshaft to the piston for the purpose of compressing or ejecting the fluid in the cylinder. In some engines, the piston also acts as a valve by covering and uncovering ports in the cylinder wall. The petrol enters inside the cylinder and the piston moves upward.

4.3. Belt

A belt is a loop of flexible material used to link two or more rotating shafts mechanically, most often parallel. Belts may be used as a source of motion, to transmit power efficiently, or to track relative movement. Belts are looped over pulleys and may have a twist between the pulleys, and the shafts need not be parallel. In a two pulley system, the belt can either drive the pulleys normally in one direction (the same if on parallel shafts), or the belt may be crossed, so that the direction of the driven shaft is reversed (the opposite direction to the driver if on parallel shafts). As a source of motion, a conveyor belt is one application where the belt is adapted to carry a load continuously between two points.

V DESIGN CALCULATION

Calculation of Hydraulic Cylinder

Forces acting on cylinder:-

1. Piston Area (A):-

$A = (\pi/4) \times D^2$

$= (\pi/4) \times (25 \times 10^{-3})^2$

$= 2.01 \times 10^{-4}\ m^2$

2.Piston rod Area (a):-

$a = (\pi/4) \times d^2$

$=(\pi/4) \times (10 \times 10^{-3})^2$

$= 7.85 \times 10^{-5}\ m^2$

Mass = 12.29 kg

3. Force during extending stroke:-

$P = F/A$

$6 \times 10^5 = F/(2.01 \times 10^{-4})$

$F = 120.6\ N$

$Mass = F/g$

$= 120.6 / 9.81$

4. Force during retracting stroke:-

$P = F / (A-a)$

$6 \times 10^5 = F / (2.01 \times 10^{-4} - 7.853 \times 10^{-5})$

$F = 73.47\ N$

Theoretical force at 6 bar when advancing of piston = 125 N

Piston rod threading end = M10 x 1.5 pitch

5. Direct Tensile or Compressive stress due to an axial load

$$fc_{act} = \frac{120.6}{(\pi/4) \times (10)}$$

$fc_{act} = 1.5355\ N/mm^2$

$fc_{all} = 380/2$

$= 190\ N/mm^2$

As $fc_{act} < fc_{all}$ Piston rod is safe in compression.

VI CONCLUSION

- Required human efforts for cutting node will be reduced.
- Less time will be taken.
- Skilled person not required for cutting nodes.
- Maximum nodes will be cut at minimum time so efficiency will be increased
- More Profit
- Reduce man power
- Mass production
- Farmer can overcome the labour crises problem

VII ACKNOLEDGEMENT

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