DESIGN AND FABRICATION OF SUGARCANE NODE CUTTING MACHINE

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***ABSTRACT*: In today's competitive world needs faster rate production of agriculture products. To produce maximum sugarcane yield, traditional method is not suitable as 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 as a seed by planting machines.**

***Keywords*: Image Processing, Sugarcane Planting**

I. INTRODUCTION

Nowadays, 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 as a seed by planting machines. The number of applications using machine vision and digital image processing techniques in the agricultural sector is increasing rapidly. These applications include land/aerial remote sensing of crops, detection and recognition of pathological stress conditions, shape and color characterization of fruits, among many other topics. In fact, quantification of the visual properties of horticultural products and plants can play an important role to improve and automate agricultural management tasks.

II. PROBLEM STATEMENT

There Sugarcane planting with traditional method is costly, time-consuming, requires great human force and high volume of sugarcane stalk per hectares. Also the existing (traditional) tools used for bud chipping of sugar cane are unsafe, messy and need skill and training. The risk of injury is also too high. This necessitates the development of a node cutting machine for sugar cane. Now a day's 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. This ultimately results into more population of sugarcane stalk which affects the yield. Sometimes, cut may appear on the bud as well, which results into no germination of the bud and we lose the seed. 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. This project deals with solutions to overcome these problems and talks about use of image processing method for seed selection.

III. OBJECTIVES

- To reduce the human effort required for sugarcane planting by developing automated sugarcane node cutting machine.
- To develop machine which have proper control on cutting location so cut cannot appear on node.
- To cut maximum nodes at minimum time so efficiency will be increased.
- To develop machine which is economical and suitable for effective implementation of polybag technique of planting.

IV. SCOPE

The existing sugarcane node cutting machine machines do not have control on cutting location. To achieve such accuracy by providing control on cutting location it is simple and effective to use of image processing method. So there is vast scope to increase the accuracy and effectiveness of machine by providing control on cutting location by image processing system.

IV METHODOLOGY

Proposed methodology starts with assumption that the sugarcane node is said to be normal if the difference between two consecutive nodes is less than 30 % and there is no crack on stalk. The system consists of following important components

1. Personal Computer (PC),
2. Charged Coupled Device (CCD) camera and Lighting system,
3. Control system and Cutter,
4. Conveyor belt drive system.

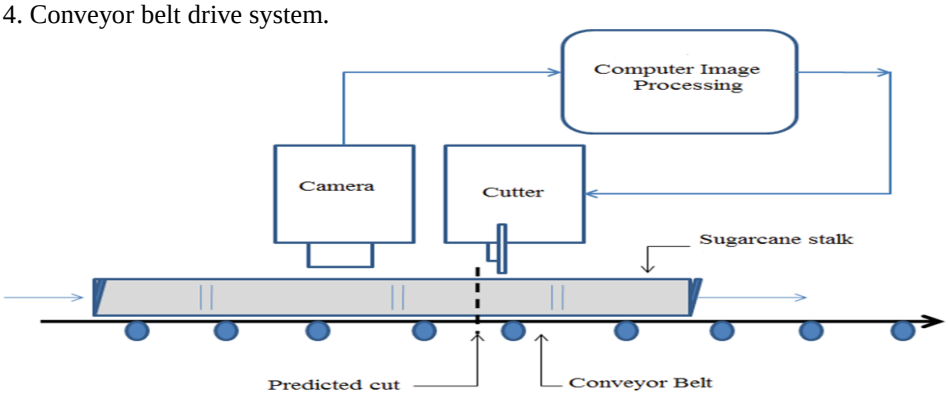


Figure 1.: Proposed system for seed selection

V. DIFFERENT METHODS OF PLANTING

1 Conventional method of planting: Placing of two / three budded setts in furrows opened by bullock or tractor drawn implements is the most common method of sugarcane planting in India called conventional method of planting. However, the method requires huge quantity (6-7 tonnes cane stalk / ha) of planting material. So about 4000 kg of cane per acre may required.

2 Sustainable Sugarcane Initiative (SSI): In Sustainable Sugarcane Initiative (SSI) method single eyed sets are used for planting. In this method sets are directly grown in nursery in portrays using single budded chips that are transplanted into the field after 30 to 35 days from the date of plantation. Sustainable Sugarcane Initiative is an innovative method of sugarcane production using less seeds, less water and optimum utilization of fertilizers and land to achieve more yields. By using this method only about 5000 single budded chips (500 kg of cnne per acre) is required.

3 Polybag technique of planting: In this technique, fertile soil is filled in one kg. Polythene bags, small holes made in the bottom portion of polythene bag for aeration, single bud cuttings made from topone third portion of seed cane stalk, planted horizontally with bud position upward in top one fourth soil portion and covered with thin soil layer followed by applying water with a watering cane. Polybags are ready for transplanting in the field 30 days after planting by which time they attain 4-5 leaf stage. The poly cover is removed with a blade at the time of transplanting. Raising of sugarcane crop by Polybag technique requires only 1.5 to 2.0 tonnes seed cane per hectare while in conventional sett planting, 6-7 tonnes seed cane per hectare is needed.

VI. DESIGN FUNDAMENTAL

- **Basic part selection and designing:** Following are important part which is to be design or selected:
    1. Frame.
    2. Belt conveyor (with roller support)
    3. Pneumatic cylinder.
    4. Cutting tool.
    5. Image processing system.

1 Frame: Frame is the basic structure for support the main component like belt conveyor, pneumatic cylinder, cutting tool etc. Frame should be selected with suitable dimensions and material .Mild Steel (M.S. bar) is most convenient material for frame.

2 Belt conveyor: For conveying the sugarcane stalk we can use simple flat belt.

Selection of belt conveyor by assume values from sugarcane dimensions

- Maximum length of belt=1000mm
- Maximum width of belt=70mm
- Roller diameter=50mm

- Mass capacity M= ρQ=(Density x Volume flow) = 713.0 x 0.1718

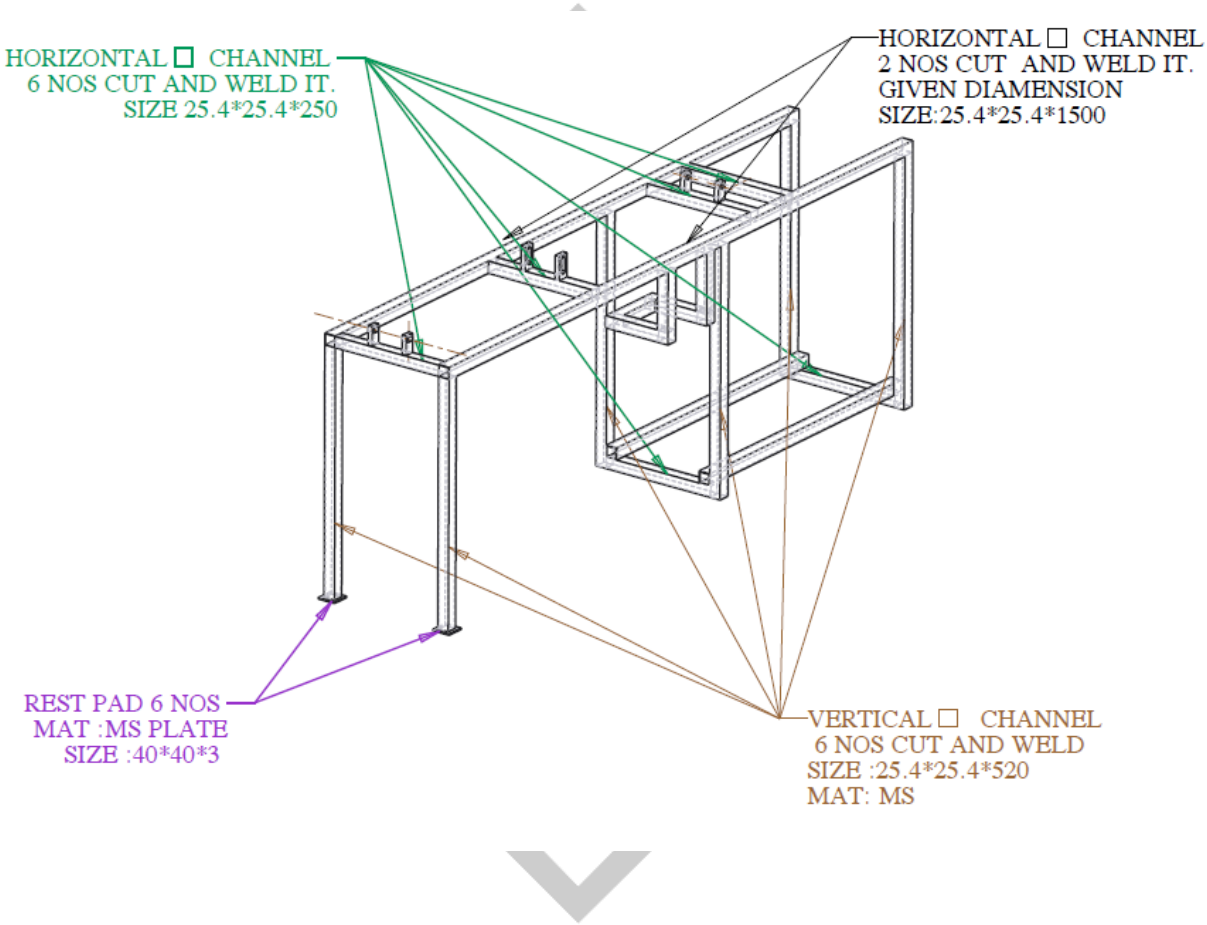
  =122.49kg/hr

3. Pneumatic cylinder: During selection of pneumatic cylinder, cutting resistance and maximum cutting force should consider. As maximum cutting pressure require is up to 0.5 N/mm^2 . So pneumatic cylinder with operating pressure range 1 to 6 bar is suitable.

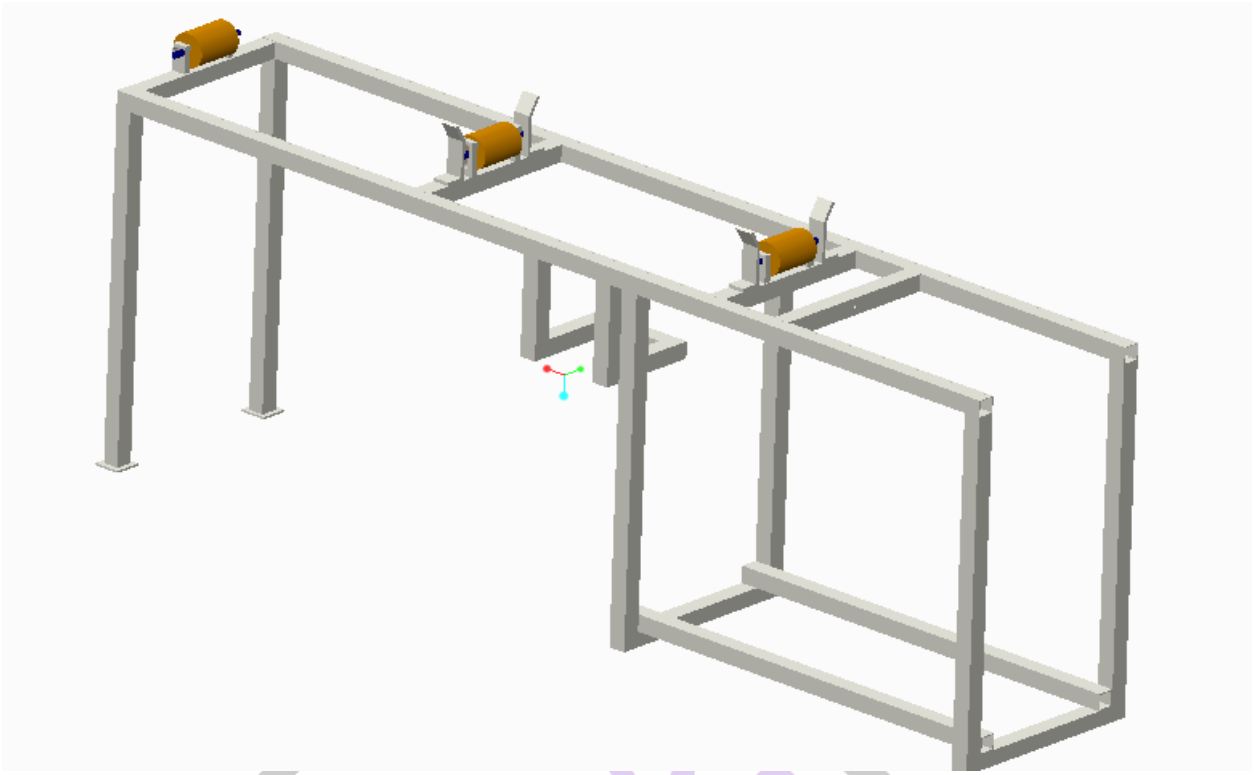
4. Cutting Blade: A blade is the portion of a tool weapon or machine that is designed to puncture, chop, slice or scrape surfaces of materials. Here the function of tool is to chop or cut the sugarcane. High speed tool steel or carbide tool can be suitable for blade, but for cost consideration we suggest carbide tool.

VII. FABRICATION OF PROPOSED PROTOTYPE

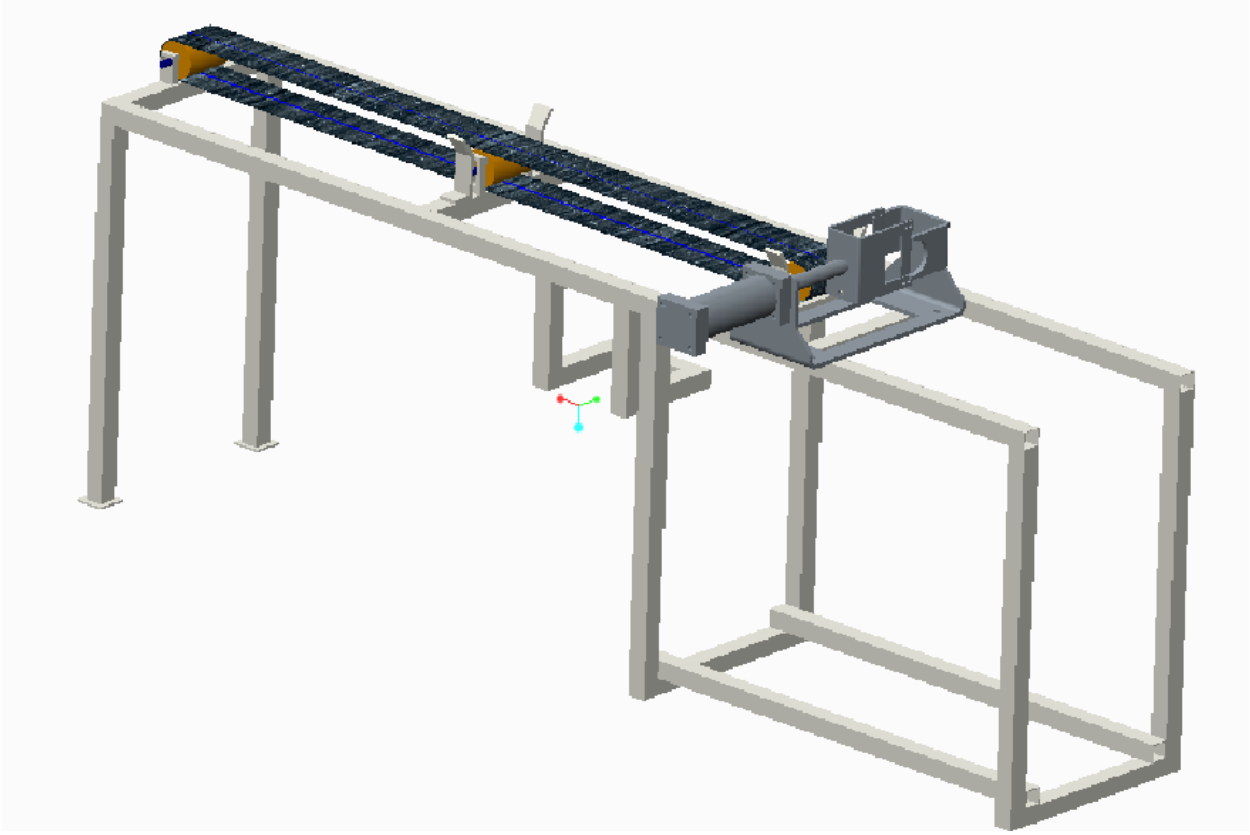
Step 1: Fabrication of basic frame:



Step 2: Assemble roller and axle



Step 3 Add belt,cutting blade and cutting support(with pneumatic cylinder)



Step 4 Add side plate and collection box

VIII. EXPERIMENTAL VALIDATION

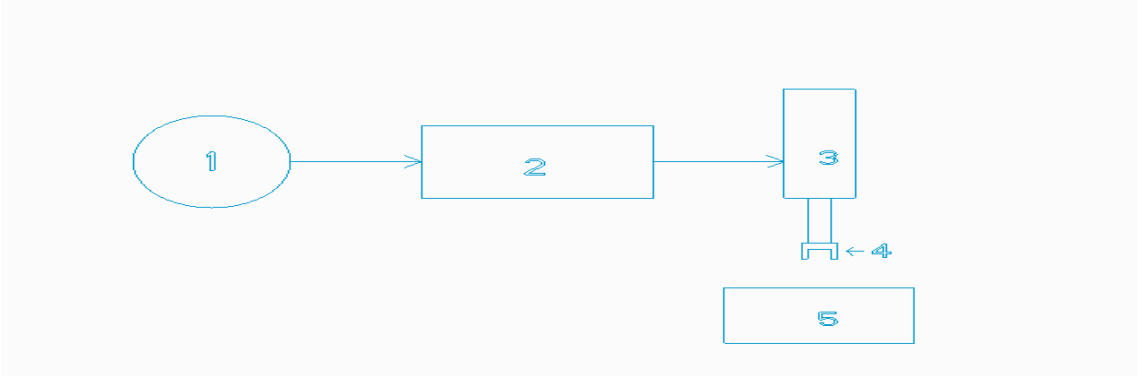


Fig 2. Image processing working

1) Image capturing device.(camera)

2) Microprocessor.

3) Prime mover (pneumatic cylinder)

4) Cutting blade

5) Cutting platform

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 (pneumatic 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.

IX ADVANTAGES

1) Required human efforts for cutting node will be reduced.

2) Less time will be taken for cutting node.

3) Skilled person not required for cutting nodes and Farmer can overcome the labour crises problem

4) Maximum nodes will be cut at minimum time so efficiency will be increase

X CONCLUSION

After the completions of this project, following conclusions were made, i.e, the automated sugarcane bud chipping machine is fabricated and assembled as per the proposed design. This machine cut the node automatically so the newly developed machine is more effective for sugarcane planting.

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