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Design and Fabrication of Pneumatic Sugarcane Bud Cutter

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Abstract: *Sugarcane is one of the most widely farmed crops over the globe. After harvesting sugarcane, cutting the sugarcane into chunks is a very time-consuming process. All sugarcane cutting machines are either manual or semi-automatic. This involves a lot of time and labor for each machine since the operation is not fully automatic. So here we propose a fully automatic sugarcane bud cutter that utilizes pneumatic power for automatic sugarcane cutting mechanism. The system makes use of a mini tabletop machine with a powerful motorized arrangement to push an entire sugarcane bud into the machine cutter. Once a sugarcane stick bud is inserted a rubber gripper roller powered by a geared motor is used to drive the stick towards the cutter at a specific rate. A second roller is attached to the system through a screw-based arrangement and is used to push the sugarcane stick towards the other roller and maintain a grip over the cane. The system is further integrated with a pneumatic cylinder. A cutter blade is attached to the front end of the actuator. The pneumatic cylinder is powered by an external compressor to drive it back and forth using high air pressure. This blade is used to cut the sugarcane bud into equal pieces in coordination with the feeder rollers. The machine uses rollers to pull in the sugarcane stick and a cutter to cut it. Now the system also includes a controller circuitry that controls the cutting length of each piece. This allows the operator to cut the sugarcane in desired pieces.*

Keywords: Cutting Blade, Sugarcane Bud Cutting Machine, Cutting Bud, etc.

I. INTRODUCTION

The agriculture sector of India has occupied43% of India's geographical area, and is contributing 16.1% of India's GDP. Agriculture still contributes significantly to India's GDP despite decline of its share in India's GDP. There are number of crops grown by farmers. These include different food crops, commercial crops, oil seeds etc. Sugarcane is one of the important commercial crops grown in India. Approximately 80% of the world's sugar is produced from sugarcane in tropical and subtropical climates, 70 countries produce sugar from sugarcane, 40 from sugar beet and 10 from both. In agricultural harvesting we require maximum man power, ample money and also it is more time-consuming process.

In cutting process, we face various problems and these are not easily solved. The design of this machine is very simple also easy to implement. In this manner we are designing the Sugarcane Cutting Machine to reduce effort and time. In sugar cane farms we are using this machine for cutting purpose. This is user friendly cutting machine; anyone can handle this machine in any working condition. Skilled persons are not required for operating this machine. The need for sugar cane bud chipper is only for the farmers, where they are using a full size of sugarcanes in the field for the plantation purpose, while using this sugar cane bud chipper. we can cut it down in to small pieces, compact in size it can also use for plantation from this we can save the wastage of remaining portion of the sugar cane.

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II. LITERATURE SURVEY

1. "Sugarcane Cutting Machine" By Vahid Jamadar, ArbazSawar, Hemant Pol, Niraj Deshpande, Sandip Sawant, Vishnu Patil.
   This research paper helps to design and fabricate small scale sugarcane cutting machine for sugarcane harvesting to reduce farmer's effort and to increase production of agricultural goods. Compared to manual harvesting this machine has a capacity to cut canes in faster rate. It is economical. This paper helps in laying design foundation for any aspiring user to fabricate a machine for application in their farms. It helps improve economic growth of the nation. In cutting process, we face various problems and these are not easily solved. The design of this machine is very simple also easy to implement. In this manner we are designing the Sugarcane Cutting Machine to reduce effort and time. In sugar cane farms we are using this machine for cutting purpose. This is user friendly cutting machine; anyone can handle this machine in any working condition. Skilled persons aren't required for operating this machine Comparing with manual harvesting half of harvesting time and need of labours are reduced.
   The cost of harvesting is reduced by many folds when compare to manual harvesting. Automation has very huge scope in both cultivation and harvesting of such agricultural application. Sugarcane is tall grass with thick stalk and is cut manually by steel blades and transported to nearly sugar factories. The present sugarcane harvesters are big in size and of huge cutting capacity. Due to their size, it is next to impossible to use these automatic harvesters in the small farm. It is also not very economically viable to the poor segment of the country like here in India. In this paper an attempt is made to design and manufacture a small semiautomatic sugarcane cutter by fabricating it locally and hence prove using this design people may fabricate their very own semi-automatic cutters at their locale. The design is very simple and can be fabricated with local fabricators.

2. "Sugarcane Bud Chipper with Multi Cutter usingSlider Crank Mechanism" by N. Dileepan, G. Sivakumar, V. Sathishkumar, M. Siranjeevi, J. Thulasirajan.
   This paper helps to design and fabricate small scale sugarcane cutting machine for sugarcane harvesting to reduce farmer's effort and to increase production of agricultural goods. Compared to manual harvesting this machine has a capacity to cut canes in faster rate. It is economical. This project helps in laying design foundation for any aspiring user to fabricate a machine for application in their farms. It helps improve economic growth of the nation. In manual harvesting to cut one acre of sugarcane 15-16 labours are required they take 3 days to cut one acre. By using this machine problem of the labour crises can be reduced. Comparing with manual harvesting only 18% of labours are required, it makes the process faster hence reduces most of the harvesting time and labour required to operate the machine is also less. This machine is helpful for both small and big farmers.
   To overcome these problems this project work aims to develop low-cost sugarcane harvesting machine which is more efficient and having simple mechanism for cutting the sugarcane at a faster rate. The purpose of developing this machine is to reduce cost and time required for sugarcane harvesting. Sugarcane harvesting machine which is economical, more efficient and cuts the sugarcane at faster rate and it will be helpful for small scale farmers, unskilled labour can also operate without difficulty. By using this harvesting machine, we can also solve the problem of labour shortage.
   The need for sugar cane bud chipper is only for the farmers, where they are using a full size of sugarcanes in the field for the plantation purpose, while using this sugar cane bud chipper, we can cut it down in to small pieces, compact in size it can also use for plantation from this we save the wastage of remaining portion of the sugar cane. The sugarcane machine is very useful to small scale farmer to planting sugarcane bud .and also time is saved by this process as compared to the traditional system of sugarcane bud plant. Extra sugarcane waste in small form that can be saved by using sugarcane bud cutting machine that can be used as a white sugar production and juice. Also, the wood cutter is very useful for the farmer sand it reduces the human.

3. "Design and fabrication of sugarcane node cutting machine" by Siddhesh Phapale, Prof. A. A. Tamboli, Prof. D. L. Shinde.
   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

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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. 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. 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 colour 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.

III. DESIGN OF PNEUMATIC CYLINDER

Pneumatic Cylinder:

Given data:

Selecting Cylinder: 25

1. Area of Piston

π/4*25^2

490.873 mm^2

2. Volume of cylinder = stroke *area of piston

25*π/4*25^2

49087.385 m^3

3. Outstroke force (F) = pressure *Area of cylinder

0.4*490.873

196.349 N

4. Piston rod area A1

π/4*d^2 π/4*8^2

50.20 mm^2

5. Effective area = piston area- piston rod area

= 490.873 -50.20 = 440.673 mm^2

6. In-stroke force = P*A

= 0.4*440.673

= 176.2692 N

7. Motor Calculation:

Total mass of the Sugarcane=2kg. Total force is calculated by,

F=m*a

= (2*9.81) =20 N

So, on each wheel load is equals to (20/2) =10N

We are using One inch diameter (25.4mm) wheels hence the total required torque is calculated as, T=F*R

= (10 * 0.0127)

= 0.127 N-m---------- A

Means 0.127 Watt

For 12V and 12A DC battery motor, P=V*I

= (12*2) = 24Watt.

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IV. CAD MODEL

Computer-aided design (CAD) is the use of computers to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations.

CAD is used as follows:

To produce detailed engineering designs through 3-D and 2-D drawings of the physical components of manufactured products.

1. To create conceptual design, product layout, strength and dynamic analysis of assembly and the manufacturing processes themselves.
2. To prepare environmental impact reports, in which computer-aided designs are used in photographs to produce a rendering of the appearance when the new structures are built.
3. CAD systems exist today for all of the major computer platforms, including Windows, Linux, Unix and Mac OS X. The user interface generally centers around a computer mouse, but a pen and digitizing graphic tablet can also be used. View manipulation can be accomplished with a space mouse (or space ball). Some systems allow stereoscopic glasses for viewing 3-D models. In our olden days, engineers, designers and draughts men were struggling to produce and submit engineering drawings in their scheduled times.
   It was mainly due to tremendous efforts they had taken to produce both new drawings or edited/updated drawings. Every line, shapes, measurements, scaling of the drawings - all made them headache to the design / drafting field. All these difficulties and pressures over-ridden by Computer Aided Design Drafting (CAD Drafting) technology.

The advantages of CAD include: the ability to producing very accurate designs; drawings can be created in 2D or 3D and rotated; other computer programs can be linked to the design software. With manual drafting, you must determine the scale of a view before you start drawing. This scale compares the size of the actual object to the size of the model drawn on paper. With CAD, you first decide what units of measurement you will use, and then draw your model at 1:1 scale, should one of the main benefits of CAD. When you draft manually, you first select a sheet, which usually includes a pre-printed border and title block. Then you determine the location for views' plans, elevations, sections, and details. Finally, you start to draw. With CAD, you first draw your design, or model, in a working environment called model space. You can then create a layout for that model in an environment called paper space. A layout represents a drawing sheet.

It typically contains a border, title block, dimensions, general notes, and one or more views of the model displayed in layout viewports. Layout viewports are areas, similar to picture frames or windows, through which you can see your model. You scale the views in viewports by zooming in or out. Manual drafting requires meticulous accuracy in drawing line-types, line-weights, text, dimensions, and more. Standards must be established in the beginning and applied consistently. With CAD, you can ensure conformity to industry or company standards by creating styles that you can apply consistently. You can create styles for text, dimensions, and line-types. With manual drafting, you use drawing tools that include pencils, scales, compasses, parallel rules, templates, and erasers. Repetitive drawing and editing tasks must be done manually.

In CAD, you can choose from a variety of drawing tools that create lines, circles, spline curves, and more. You can easily move, copy, offset, rotate, and mirror objects. You can also copy objects between open drawings. With manual drafting, you must draw objects carefully to ensure correct size and alignment. Objects drawn to scale must be manually verified and dimensioned. With CAD, you can use several methods to obtain exact dimensions. The simplest method is to locate points by snapping to an interval on a rectangular grid. Another method is to specify exact coordinates. Coordinates specify a drawing location by indicating a point along an X and Y axis or a distance and angle from another point. With object snaps, you can snap to locations on existing objects, such as an endpoint of an arc, the midpoint of a line, or the center point of a circle. With polar tracking, you can snap to previously set angles and specify distances along those angles.

Revisions are a part of any drawing project. Whether you work on paper or with CAD, you will need to modify your drawing in some way. On paper, you must erase and redraw to make revisions to your drawing manually. CAD eliminates tedious manual editing by providing a variety of editing tools. If you need to copy all or part of an object, you don't have to redraw it. If you need to remove an object, you can erase it with a few clicks of the mouse. And if you make an error, you can quickly undo your actions. Once you draw an object, you never need to redraw it.

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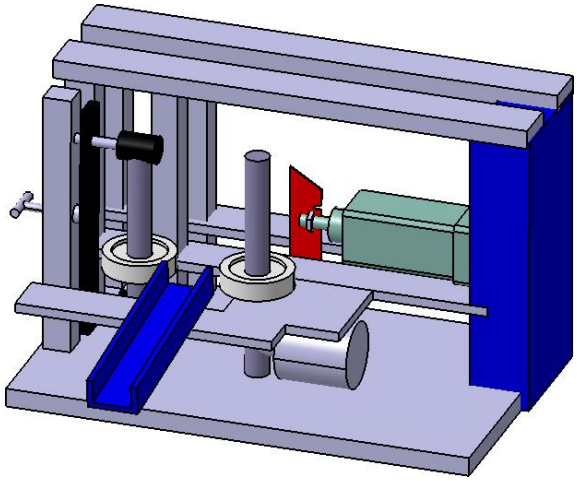
To work efficiently using the cad the organisation must focus on the following areas where it needs to be on upper side. Most popular CAD software like AutoCad, ProgeCAD, Microstation are high priced for individuals. Alternatively, individuals can try free opensource CAD drafting software QCAD, LibreCAD and OpenSCAD.Every new release of the CAD software, operator has to update their skills. Improper use of blocks and layers make updating and modification of the drawings a cumbersome task for another person.



V. CONCLUSION

We have successfully designed and done the material selection for this project. For that purpose, we have used the CATIA V5 R20 software. As total deformation and equivalent stress (in vertical direction) is very minimal, the design for Design and Fabrication of Pneumatic Sugarcane and Bed Cutter is same.

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