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Automatic Node Cutting and Planting of Sugarcane

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Abstract: ***Sugarcane is one of the largest cultivated crops in India. Traditional sugarcane planting methods are time consuming and the process of bud chipping is also not easy. Moreover it needs human efforts and high density of sugarcane stalk in a hectare for planting. In order to avoid this problem, it is decided to adopt latest technic with an auto machine for sugarcane planting. Many of machines for sugarcane planting is not adoptable by farmers, because of their cost. To reduce the human effort and cost, it is decided to design an automatic sugarcane node cutting and planting machine. It is suggested that this setup is user friendly and economic for farmers. The process involved in this project are node sensing, cutting and planting. In this, the sugarcane stalk is fed to the passage where sensor is made to sense the node. After receiving the positive signal from the sensor, arduino gives command to the slider crank mechanism driven motor that consists of two fixed blades of 30mm gap between them. After finishing the cutting process that chipped node portion is made to fall into the pit, which is created by the front portion of our setup. Once the node fells down, the whole setup is made to move 150mm by using another dc motor through arduino. Automation helps us to reduce man power and damages sugarcane while planting.***

Keywords: Sugarcane stalk, Arduino, Slider crank mechanism, Blade, Automation

I. INTRODUCTION

Sugarcane is one of the largest cultivated crops in India. It is the third important cash crop in India. Sugarcane is the renewable resource crop.

Traditional sugarcane planting methods are time consuming, and bud chipping is not easy. Moreover it needs human efforts and high density of sugarcane stalk in a hectare for planting. Sugarcane 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. Sugarcane is grown primarily in the tropical and sub-tropical zones of the southern hemisphere. Sugarcane is the raw material for the production of white sugar, jiggery. It is also used for chewing and extraction of juice for beverage purpose [1]. Also, the existing manually operated sugarcane bud cutting machines used for bud chipping of sugar cane are unsafe because of risk of injury is too high and need skill and training to operator. However, traditional machines do not have cutting location control. Sometimes, cut may appear on the bud as well, which results into no germination of the bud and we lose the seed [2]. In order to avoid this problem, we develop a mechanism in a machine for sugarcane planting. Many of the machines for sugarcane planting are not adoptable by farmers due to their cost. This setup is user friendly and economical to farmers. The process followed is node sensing, cutting and planting.

II. LITERATURE REVIEW

A. Tamboli Z, S.V. Phapale, P.V.Patil, K.B. Sapkal, R.N. Yannawar [1]

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.

B. TejaswiPatil, ParthRansubhe, DurgaTatke [2]

Automation in agriculture is necessity to reduce human efforts as well as human errors. In India sugarcane is a widely cultivated crop. Now day's sugarcane plantation is done using a polybag technique. For this technique proper bud from sugarcane with proper shape is important factor. In this paper we are considering the issue like shape of bud, real time image processing and complete automation for bud cutting. Solution is provided to change the compare capture method of image processing to reduce the requirement of large database.

C. Mahesh Bhandare, ChavanAkshay, DhaigudeRajkumar, Gaikwad Ganesh, Jadhav Sunil [3]

Now a day's most of the agricultural equipment is working on the automatic system. We know that agriculture is the backbone of the Indian economy and Indian farmers are facing the problem of shortage of worker for doing the on field work. To overcome this problem we are designing the sugarcane bud cutting machine which reduces the wastage of sugarcane and also reduces the transportation cost. The production of bud using this automatic sugarcane bud cutting machine is high as compare to other conventional machines available in the market. The buds cut by using this machine are light in weight and economic sugarcane seeding material. These technique of farming using the buds helps to the farmer developing the new varieties of the sugarcane. There is problem of initial growth using the sugarcane bud but it can be overcame using the suitable growth regulators and fertilizers.

Also this machine faster production rate which make it suitable for the competition with conventional sugarcane bud cutting machine.

D. H.A. Abd El Mawla, B. Hemida, W.A. Mahmoud [4]

Transplanting technique has been applied in several countries for reducing the duration of sugarcane production season. Sugarcane transplanting has been recommended as an alternative planting method for saving considerable part of irrigation water that determines the expansion of agricultural area in the country.

The technique also achieves several advantages such as saving seed quantity, labor power and total costs of sugarcane production. Farmers have been facing problems concerning trans-plating cane seedlings in the main field. Manual transplanting of sugarcane seedlings in the dry soil of the field is slow, inaccurate, costly and tedious task. The current research devoted to study the application of transplanting cane seedlings including nursery growing and mechanical transplanting to facilitate easy application of the technique.

III. OBJECTIVES

A. To develop machine which have proper control on cutting location so cut cannot appear on node and cut maximum nodes at minimum time so efficiency will be increased.
B. To reduce the human effort required for sugarcane planting by developing automated sugarcane node cutting machine.
C. To minimize the node cutting time.
D. To reduce number of sugarcane stalk required per hectare
E. To plant sugarcane with proper spacing
F. To reduce the labour cost
G. To increases the growth of the sugarcane

IV. COMPONENTS USED

1) *Plouging Tool:* Ploughing tool in front position is made to create pit along the direction of movement of this setup where the sugarcane to be planted.
2) *Roller Conveyor*: For conveying the sugarcane stalk simple roller conveyor is used. Selection of belt conveyor by assume values from sugarcane dimensions. This roller conveyor is operated by DC motor.
3) *Motor*: Three arduino controlled DC motors using battery as source are used. One to operate the conveyor. Another to provide motion to cutter blade and other motor is to move the whole setup which is connected with the wheel shaft through chain drive.
4) *IR sensor:* IR sensor at the end of conveyor is made to sense the node of sugarcane. This IR sensor is connected with arduino, it gives input signal to it.
5) *Arduino:* Arduino is a single-board microcontroller to make using electronics in multidisciplinary projects more accessible. This arduino is connected with sensor, motors and battery.
6) *Cutting Blade*: A pair of blade with 30mm gap is designed to chip the sugarcane stalk, found near the sensor. High speed tool steel or carbide tool can be suitable for blade, but for cost consideration we suggest carbide tool. This cutting blade is made to operated by slider crank mechanism driven motor.

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V. PROPOSED METHODOLOGY

This machine consists of a ploughing tool in front portion to create a pit for sugarcane to be planted. The sugarcane stalk is fed by the conveyor through hopper, which is driven by a motor. We need to place the sugarcane stalk into the hopper. The tapered end of the conveyor helps to feed a single stalk at a time. This stalk is allowed to pass through the sensor to sense the node of the sugarcane. Once the node is sensed, it gives an input to the arduino. This arduino sends a command to the conveyor motor to switch OFF and the cutter motor to switch ON for one revolution by slider crank mechanism. The cut node is made to fall onto the pit. When this cycle is completed, the whole setup is moved by 150mm to repeat the same cycle. This movement is provided by a high torque motor controlled by arduino. Rear portion consists of a small setup which closes the pit with the node by soil.

VI. PROCESS FLOW DIAGRAM

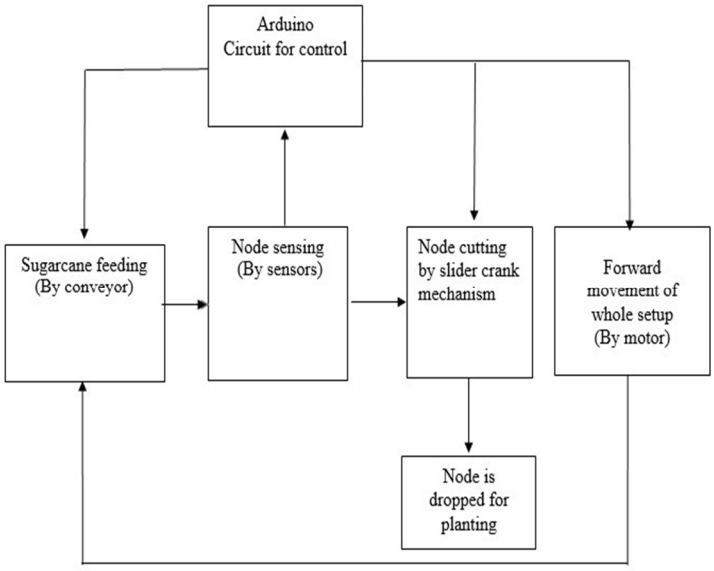

Figure 1: Process Flow Diagram

VII. CONCEPTUAL MODEL

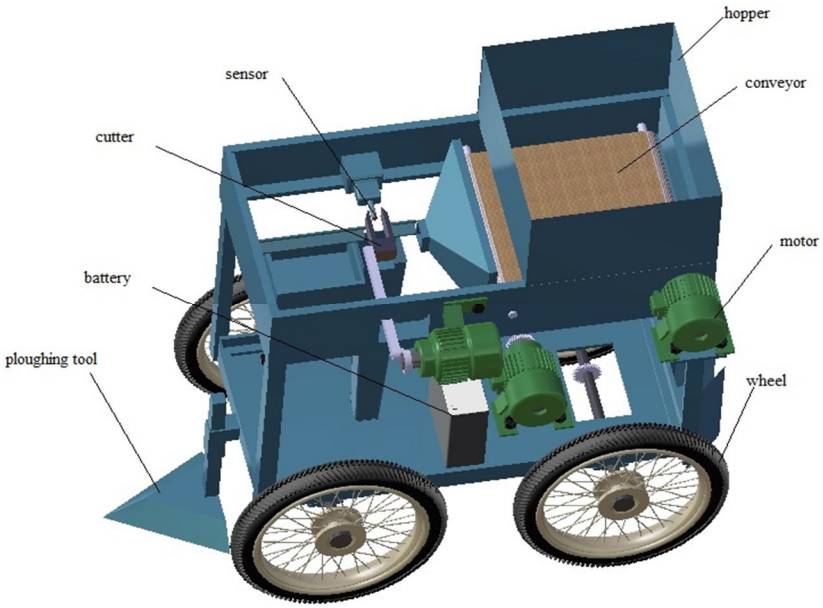

Figure 2: Conceptual Model

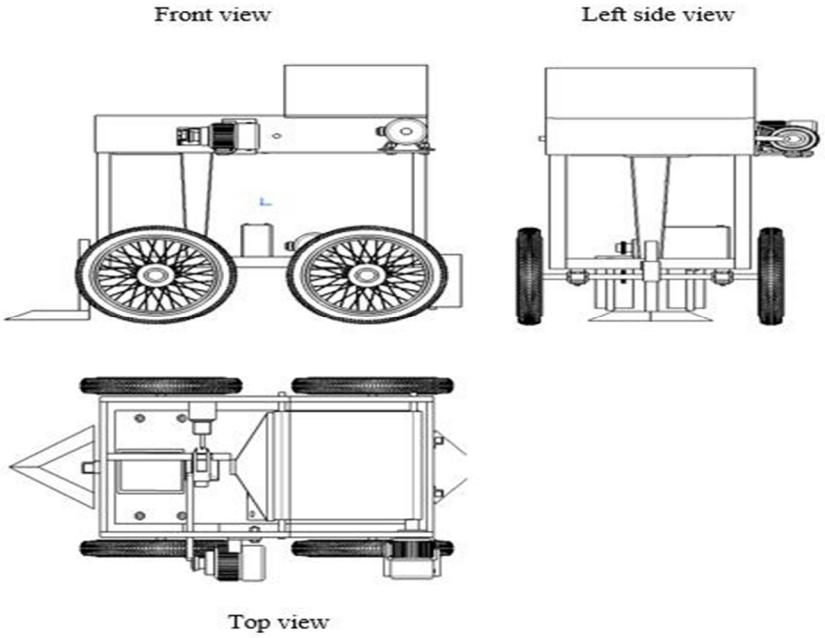

Figure 3: Schematic Diagram

VIII. ADVANTAGES

A. It reduce the labor cost
B. It reduce human effort for node cutting
C. It plant sugarcane with proper spacing
D. It reduce number of sugarcane stalk required per hectare
E. It minimize the node cutting time.
F. It increases the growth of the sugarcane

IX. CONCLUSIONS

This automatic node cutting method is a time saving and economical alternative for reducing the cost of sugarcane production. Normally, 5 to 6 tons of sugarcane is required for planting an acre of land if 16000 budded stalks are used (approximately). However, if node cutting is used only 140-150 Kg is sufficient resulting in a saving of about 97% of cane by weight. This is economical in terms of the crop cultivation cost. It also saves several thousands of tons of raw material since the de-budded stalk could be sent to crushing centers for extracting sugar. Also this automatic plantation reduces the human effort and also provides proper spacing.

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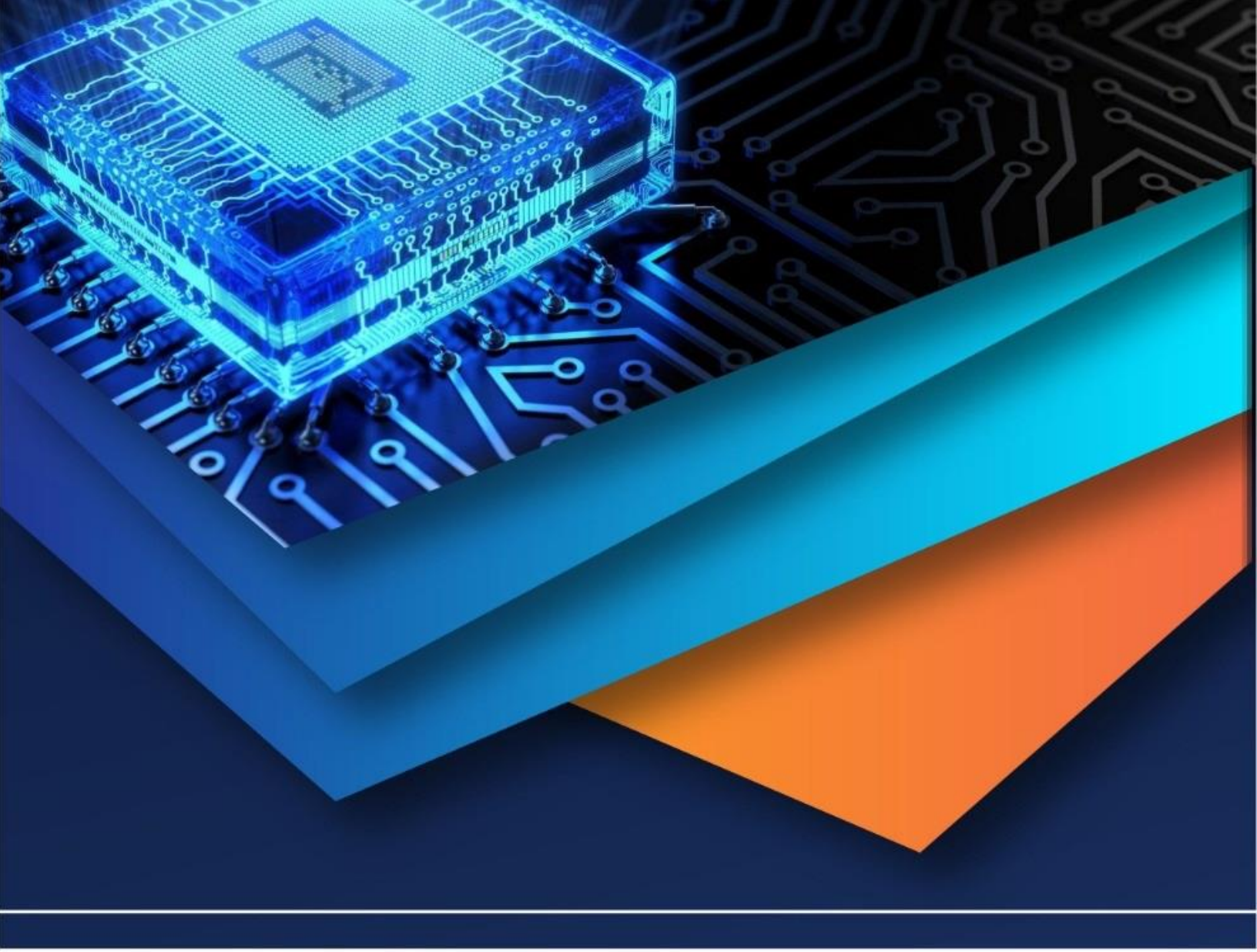

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