

Fabrication of Solar Powered Sugarcane Harvesting Machine

K.Arjun ^[1], Ch.Venkat Suneel ^[2], D.Lokesh Reddy ^[3]

SK.Afrid Basha ^[4], V.Sunil Kumar ^[5]

Student ^{[1], [2], [3], [4]}, Assistant professor ^[5]

Department of Mechanical Engineering

Narayana Engineering College, Gudur

Andhra Pradesh – India

ABSTRACT

In today's world there is a heavy demand of sugar and its byproducts. Sugarcane is the world's largest crop and it is estimated that it was cultivated on about 23.8 million hectares in more than 80 countries with a worldwide harvest of 170.9 million metric tons. **India** is the leading producer of sugarcane in the world at about 17.9% in 2016-17. The major states growing sugarcane are Maharashtra, Uttar Pradesh, Karnataka. In India there is a scarcity of labors in agriculture. Day by day labor wages are increasing. The project aims to design and fabricate small scale sugarcane harvesting machine with solar power operated for sugarcane harvesting to reduce farmer's effort and to increase the output of agricultural products. It is easy to operate, less maintenance, eco-friendly and no skilled labors is required.

Keywords:- Sugarcane harvesting¹, agricultural products² eco-friendly³, low cost⁴

I. INTRODUCTION

India is the largest producer of sugarcane in the world. Harvesting is the process of cutting and gathering of mature crop from the field. In India agriculture is facing serious challenges like scarcity of agricultural labor, not only in peak working seasons but also in normal time. Due to these different types of harvesting machines are introduced and available such as wheat harvester, tea harvester etc in small scale except sugarcane harvesting machine.

In many small scale sugarcane agricultural fields harvesting is done manually that is with hand knives, cutting blade or hand axes also known as manual harvesting. It requires skilled labors as improper harvest of cane leads to loss of cane and sugar yield, poor juice quality and problems in milling due to extraneous matter. Our aim behind this project is to cut sugarcane at ground level.

In our project we have designed and fabricated sugarcane harvesting machine which works with the help battery. Battery is charged with the help of solar panel. Two cutters are provided at the ground level which can cut two sugarcane continuously from two rows. The other main components are brushless square dc motor, bevel gear and Chain drive mechanism.

II. LITREATURE REVIEW

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 this are not easily solved. So we have studied the following research paper and decided to find the best solutions of this problems by designing and fabricating the sugarcane harvesting machine which will be economical and efficient for small scale farmers.

Prashant Inkane⁽¹⁾ et al(2017) designed and fabricated a solar powered small scale sugarcane harvesting machine. It was concluded that by using this machine only 20% labor was required compared to manual harvesting.

Shridhar , Umarfarooq M A , Syed Naseeruddin , Akhilesh V⁽²⁾ et al (2017) the productivity levels of India in major agricultural crops is very disappointing. One of the primary constraints to increased productivity and profitability stems from the limited use of modern farming technology, equipment, and inputs. India is the second largest producer of sugarcane. The Agriculture workforce is declining and thus farmers need modern mechanized tools to remain in agriculture. This paper focuses on conceptual design and manufacturing of miniature sugar cane harvesting machine at low cost which will improve the productivity and helps reduction of

harvesting cost and time.

Vilas S. Gadhave, Pravin P. Gadsing, Yogesh Dike, Anil S. Jaybhaye, Pooja Londhe, Praveen K. Mali⁽³⁾ et al (2017) This machine is compact and can cut multi crops at a time, it has cutting blades which cut the crop in a scissoring type of motion. It runs on electric motor of 1.5hp this power from engine is provided through pulley and gearbox arrangement to the cutter.

Siddaling S⁽⁴⁾ et al (2015) This project aims to design and fabricate small scale sugarcane harvesting machine for sugarcane harvesting to reduce farmer's effort and to increase the output of agricultural products. When compared to manual harvesting, this machine can cut the lower and upper portion of the sugar cane containing leaves, simultaneously by setting the optimum movement of the rotary blades.

T. Moontree⁽⁵⁾ et al (2012) developed sugarcane harvester using small engine with a focus to help farmers in sugarcane farming who are encountering problems of labor shortage and sugar factories lacking sugar cane for producing sugar

III. MAJOR COMPONENTS OF SUGARCANE HARVESTING MACHINE

BRUSHLESS SQUARE D.C MOTOR

Brushless dc electric motor (BLDC)

also known as electronically commutated motors (ECMs) are synchronous motors powered by dc electrically via an inverter/switching power supply which produces an ac/bi-directional electric current to



Fig. SOLAR PANEL.

BATTERY

A rechargeable battery, storage battery or secondary cell is a type of electrical battery which can be

each phase of the motor via a closed loop controller. The structural elements of a brushless motor system is typically permanent magnet synchronous motor, but can also be a switched reluctance motor, or inductance motor. In our project BLDC motor(24v) is used to drive cutters at high speed with help of shaft and bevel gear. BLDC motor runs with the help of battery



Fig. BLDC MOTOR

SOLAR PANEL

Solar panel refers to a panel designed to absorb the sun rays as a source of energy for generating electricity or heating.

A photovoltaic (PV) module is a packaged, connect assembly of typically 6*10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. In our project it is used to charge the BLDC motor. charged discharged into a load, and recharged many times, while a non-rechargeable or primary battery is supplied fully charged, and discarded once discharged. It is composed of one or more electrochemical cell. Rechargeable batteries typically initial cost more than disposable batteries, but have a much lower total cost of ownership and environmental impact, as they can be recharged inexpensively many times before they need replacing

In our project we used two 12 volt, 50Amp, dry battery. The machine is operated with the help of electric motor which is connected with battery. The machine is taken out in sunrays to generate electric current and to charge the battery.

BEVEL GEAR

Bevel gears are gears where the axes of the two shaft intersect and the tooth-bearing faces of the gear themselves are conically shaped. bevel gears are most often mounted on shaft that are 90 degree apart, but can be designed to work at the other angle as well.

In our project we used the bevel gear arrangement to transmitted the power to the cutting shaft from the motor. The is power transmitted from the motor to the horizontal shaft on which bevel gear is mounted, the rotating bevel gear are in turn connected to the vertical rod which rotate the cutters.

BATTERY

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STEEL SAW CUTTER

In this project the cutter is the main component. Limited less parameter in cutting process. It was observed that sharpness is affected power requirement. A blade having leading edge thickness less than 0.127 mm required 35% less energy. Blade velocity is another important parameter in cutting process. This velocity depends upon diameter of blade and number of rpm are less the time and force required for cutting will be more and vice versa and hence optimum value of diameter and rpm must be taken into consideration. Cutting force are changed according to the diameter of stem. According to category of sugarcane. The strength and diameter of stem varies and thus the cutting force also changes.



Fig: Cutting Blade

IV. BEARING

Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.

Rotary bearings hold rotating components such as shafts or axles within mechanical systems, and transfer axial and radial loads from the source of the load to the structure supporting it.

The simplest form of bearing, the *plain bearing*, consists of a shaft rotating in a hole. Lubrication is often used to reduce friction. In the *ball bearing* and *roller bearing* to prevent sliding friction, rolling elements such as rollers or balls with a circular cross-section are located between the races or journals of the bearing assembly. A wide variety of bearing designs exists to allow the demands of the application to be correctly met for maximum efficiency, reliability, durability and performance.



ADVANTAGES

- Harvesting time will be less.
- Efficient work is done by using machine harvester.
- Limited number of labors required.
- Cost of harvesting is less as compared to manual harvesting.
- Running cost is negligible.

V. CONCLUSION

The developed model produces the weight and also eliminates the harms to the farmers. It proves to be an efficient and thus it is a step forward to enrich our rural agricultural sector. The main advantage of this developed protocol is, it doesn't affect farmer health by any means and also it doesn't contribute to green house gas emission. By encouraging conservation, increasing the investments in clean and renewable sources of energy, we can build a more secure future for our country. The performance analysis of the solar powered sugarcane harvesting machine has done for different plants with various circumferences.

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