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Fabrication of solar powered sugarcane cutting machine using chain saw

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***ABSTRACT**: In nowadays world there is more demand of sugar and its by-products. Sugar cane one and only the first industrial crop and labours required are more. Since 1600s the sugar cane crop was grown extensively till now, it has become a cash crop. From Caribbean to India and from sub tropical America it is grown .It is grown now extensively in LDC countries also. Around 20-30 million hectares is cultivated with worldwide harvest of million metric tonnes.IN India Maharashtra, U.P, Karnataka majorly cultivate these crops. But there is a huge scarcity of labors in India. Labor wages are increasing .The project aims to fabricate solar powered sugar cane cutting machine to reduce farmers effort and to save time and money. It I easy to operate, labors required is less, rugged in construction.*

KEYWORDS: Sugarcane cutting, agriculture mechanisation, low cost.

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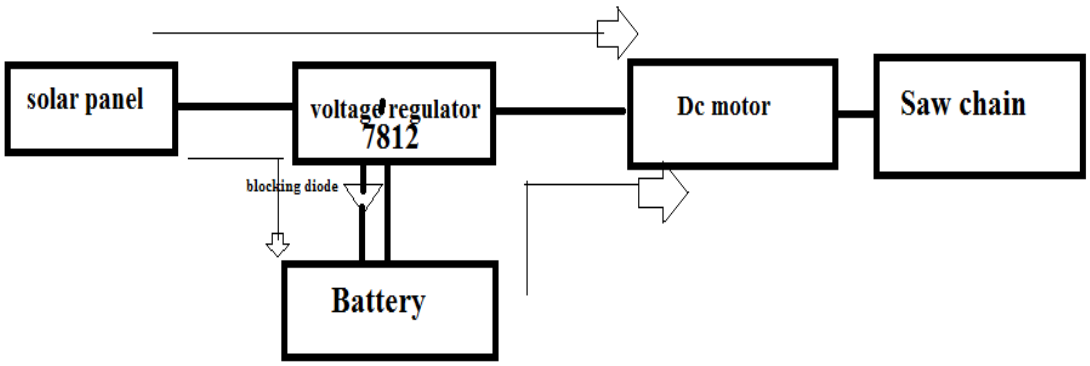
1. Introduction

Working principle:



The solar panels work on the principle of PHOTOVOLTAIC EFFECT. Light energy from sun gets converted into electrical energy (d.c) through photo voltaic conversion.

Sugar cane is the largest cash crop in the world. Harvesting is the procedure of cutting and collection of agriculture product from the field. In India agriculture has been adopted everywhere but there is scarcity of labours for Agric works, not only in khariff but also in rabi . Due to these different types of cutting machinery are developed and inaugurated and available such as paddy cutters, leaf cutters etc in low scale except sugarcane cutting machine.
Agricultural fields of sugarcane use machete, cutting blade or axe also known as simple cutting. Good skills must be there for proper finishing of cut otherwise problems may occur during production in factories.
In our project we have designed and fabricated sugarcane cutting machine which works with the help of battery. Battery acts as a backup for the project. Chain saw mechanism is placed near to the ground which can rip sugarcane more rows at a time.. The other main components are dc motor which drive the chain saw mechanism.

II. LITERATURE REVIEW

[1] Prof. N.M. Pachkhand [6] In nowadays world there is a demand for speed rate of production of agricultural products. Agriculture is main back bone of Bharat. In Bharat most farmers have labor shortage. Month by month labor wages are increasing and in the similar way there is a huge pressure on farmers. This project aims to simulate and fabricate medium scale sugarcane cutting machine to reduce farmer's running costs and to increase process of agricultural products. Different mechanisms are there in this fuel machine.
When compared to physical cutting this machine has a power to cut canes in speeder rate and it is viable.

[2]Dr. Sharad S. CHAUDHARY : There project is fabrication of medium scale cutting machine for sugarcane cutting to reduce farmer running costs and for agricultural products. Machine consists of petrol engine and different mechanisms. When compare to manual harvesting by using this machine has a capacity to cut canes at faster rate and it is useful. The machine is helpful for both whom having less acre or more acre farms.

[3] 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 22% labor was required compared to manual harvesting.

MACHETE is a vintage time cutting tool designed for manual cutting, or reaping, grains crops for more cutting of crop in those days. The tool is extremely strong, sharp, and heavy. Because of blade weight it gets proper cutting force at a time.
Normally physical cutting involves segmenting and shredding, this sometimes leads to improper cut. Many agriculture farmers use this technique as it is coming from olden times. Disparate types of machetes are used worldwide.

2 MAIN PARTS OF SUGAR CANE CUTTING MACHINE

1. SOLAR PANEL
2. DC BRUSH MOTOR
3. DC BATTERY
4. CHAIN SAW
5. WHEELS
6. DC VOLTAGE REGULATOR

Table -1:

NO	COMPONENTS	SPECIFICATIONS	REQUIRED
1	Solar panel	12V, 5watts	1
2	Dc brush motor	12V,60 watts	1
3	Dc battery	12V,7.5AH	1
4	Chain saw	18”	1
5	Wheels	polymer	4
6	Voltage regulator	LM7812	1

2.1 DC BRUSH MOTOR is a permanent magnet motor. It offers reliable operation for our project. We are using 12v,60 rpm motor. It offers high torque for heavy loads which is sufficient for cutting sugarcane.

2.2 SOLAR PANEL converts light energy to electrical energy which is in form of dc. When the photons in light falls on solar panel hit the electrons and electrons constitute current generation which is in form of d.c.current. We are using 12v,5 watt solar panel for our project .For our project the solar panel runs the dc motor during daylight.
MODELMS1205
Vm-17.1v
Power- 5 watts

2.3 DC BATTERY
In this project we are using a valve regulated lead acid battery. It is used for storing energy generated by solar panel. They are rechargeable batteries. The advantage is they are sealed and there is no leakage. We are using12v 7.5ah battery. High amperes in battery gives more time for usage. It is used for back up and solar power is main power source.

2.4 CHAIN SAW We are using a 18 inch saw chain rotated by dc brush motor. It consists of different kind of sprocket linkages used for cutting. It is made up of carbide material and is extremely durable.

2.1 solar panel

2.2 dc vrla battery

2.3 dc brush motor

2.4 chain saw

3.Calculation of labour cost in Rs/acre for Manual harvesting:

Labour cost= Rs/day
Labour cost= 400 Rs/day
(Field capacity=acre/day)= 1 acre/day

$$\text{Labourcost (Rs/tonne)} = \frac{\text{labour cost}(\frac{Rs}{acre})}{\text{yield}(\frac{tonne}{acre})} \quad (1)$$

Since yield /acre=30 tonnes, substitute this in equation(1)
Labour cost (Rs/acre)= labour cost(Rs/tonne) x yield(tonne/acre)
= 400 x30
Labour costs = 12000 (Rs/acre).
So Total harvesting costs= 12000(Rs/acre).

$$\text{Field capacity (Acre/h)} = \frac{\text{area covered (acre/day)}}{\text{total time taken to harvest}(\frac{h}{day})}$$

$$= \frac{1}{9}$$

= 0.1111 acres/hr =3.3tons approximately/hr

Labours required for 1 acre:
1 acre yield = 30 tons
Approximately 1 labour = 1 tonne
30 labours= 30 tonnes
So for cutting one acre = 30 labours are required.
Farmers gross income per acre= no of tones per acre x income per tonne(Rs)
= 30 x1200
= 36000(Rs/acre)
Net INCOME = GROSS INCOME – Total harvesting costs (FOR CUTTING)
= 36000-12000
Net income = 24000 Rs/acre

3.1Calculation of labour costs in Rs/acre for solar powered machine:

Labour cost= Rs/day
Labour cost= 400 Rs/day
(Field capacity= acre/day)= 1 acre/day

$$\text{Labour cost (Rs/tonne)} = \frac{\text{labour cost}(\frac{Rs}{acre})}{\text{yield}(\frac{tonne}{acre})} \quad (1)$$

Since yield /acre=30 tonnes, substitute this in equation(1)

Labour cost (Rs/acre) = labour charges x no. labours
= 400 x 10
= 4000 (Rs/acre).
So Total harvesting costs = 4000(Rs/acre).

$$\text{Field capacity (Acre/h)} = \frac{\text{area covered (acre/day)}}{\text{total time taken to harvest}(\frac{h}{day})}$$

$$= \frac{1}{24}$$

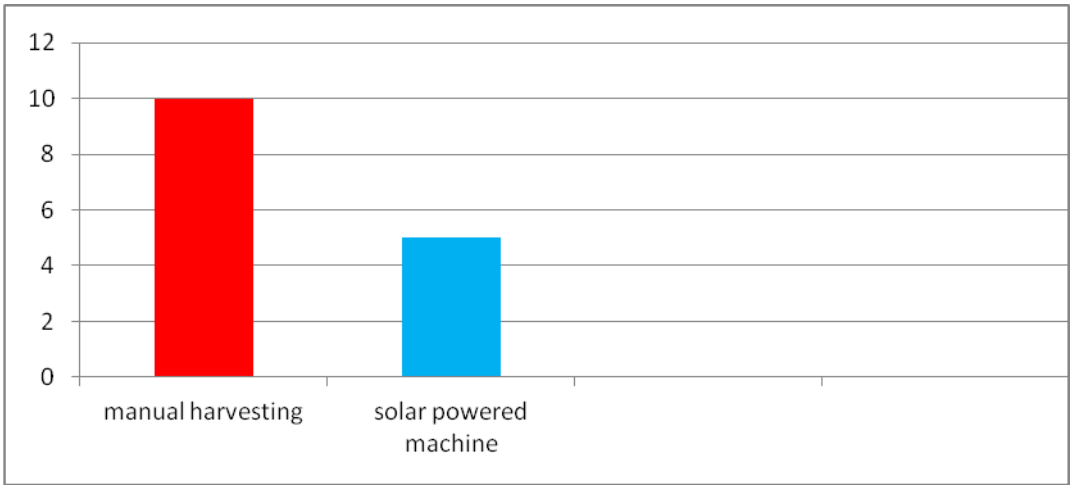
=0.041 acres/hr =1.21ton approximately.
Farmers gross income per acre = no of tones per acre x income per tonne(Rs)
= 30 x1200
= 36000(Rs/acre)
Net INCOME = GROSS INCOME – Total harvesting costs (FOR CUTTING)
= 36000-4000
Net INCOME = 32000 Rs/acre

Observed results in table format:

parameters	Gross income/acre	Harvesting cost=labour charges	Net income/acre	Tonnes /acre	Height of cut(cms)	No of labours required
Manually (Without solar powered sugarcane machine)	36000	12000	24000	30	10 cms	30
With solar powerd machine	36000	4000	32000	30	5 cms	10
		Savings=8000				

Height of cut:

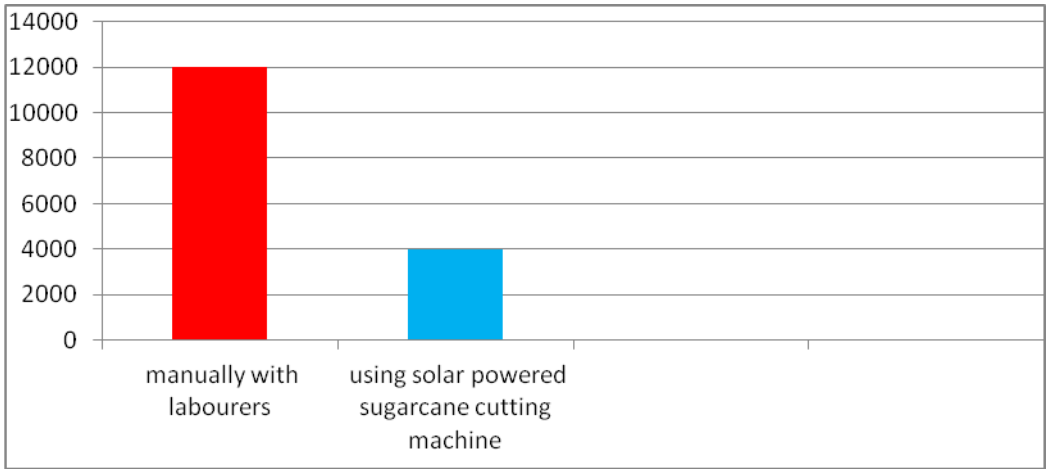
Y-AXIS=CENTIMETERS X-AXIS=TYPE OF HARVESTING



Comparing both manual cutting and sola powered sugarcane machine cutting ,height of cut is lower for solar powered machine. The height of cut for manual harvesting is 10 cm, for solar powered cutting machine it is 5cm.

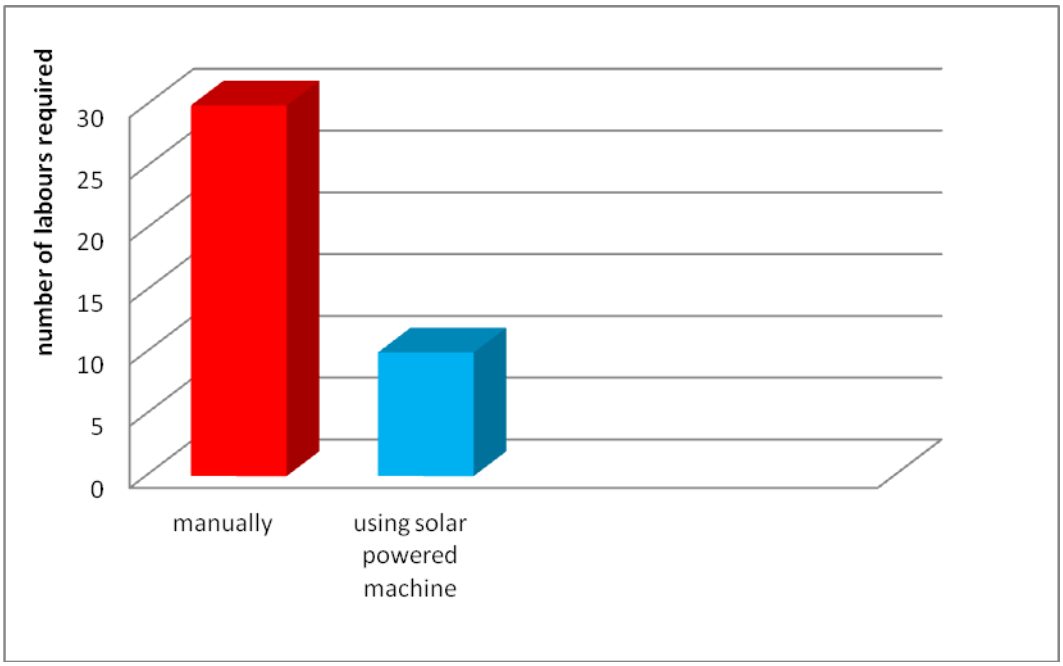
Harvesting costs for both manual and solar powered harvesting machine:

Y-axis-Rupees./acre X-axis- types of harvesting



We have saved 8000 rupees.

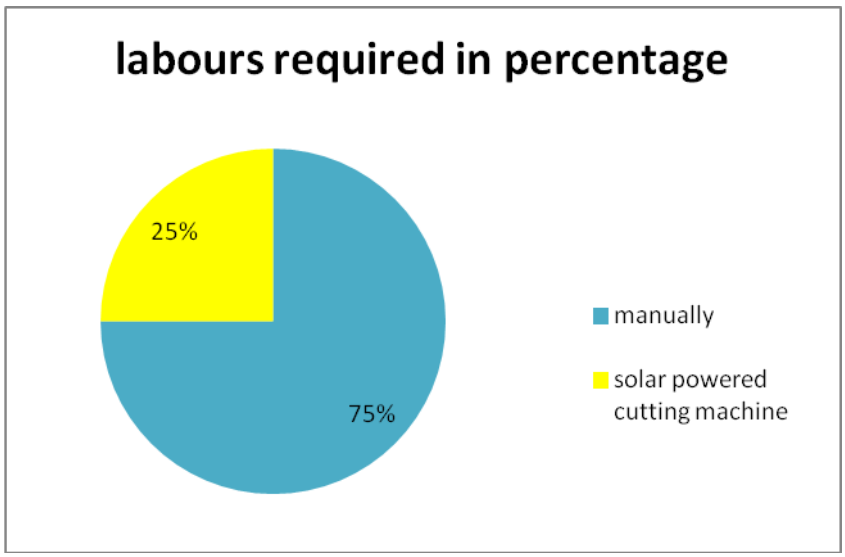
Labours required:



The no of labourers required is less for solar powered sugarcane harvesting machine than manual cutting.

Percentage of labours required for manual cutting and solar powered sugarcane cutting machine:

The percentages calculated are shown in a pie chart regarding how many labours are required for different types of harvesting.



Calculations:

Total number of labours=40

Numbers labours required for manual cutting $= \frac{\text{no of labours}}{\text{total no of labours}} \times 100$

$= \frac{30}{40} \times 100$

$=25\ \%$

Number of labours required for solar powered sugar cane cutting machine

$= \frac{\text{no of labours}}{\text{total no of labours}} \times 100$

$= \frac{10}{40} \times 100$

$= 75\ \%$

We have calculated the labour required in percentage and the percentage of labour required for solar powered sugarcane machine is **less** than manual cutting.

ADVANTAGES:

1. Cutting time is reduced.
2. Saw chain technique helps to work efficiently.
3. Labour required is less.
4. Cutting cost is reduced compared to physical cutting.
5. Negligible running cost.

CONCLUSIONS:

The cost of the fabricated machine is less and the farmers can easily handle with basic knowledge. Farmers can decrease the running cost. Physical cutting compared only **25% of labors are required**. It can cut bulk amount at a time. This is helpful for both small acre and big acre farms. We have **saved 8000 rupees.**

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