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Solar Operated Harvester System with Solar Tracker

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ABSTRACT: Farming is the backbone of Indian economy. As agriculture is the mainstay of the population, farmer required hand tools to do work, improve labour productivity and quality of work. So, we have developed agriculture needs to find new ways to improve efficiency. One approach is to utilize on the market data technologies within the style of a lot of intelligent machines to scale back and target energy inputs in additional effective ways in which than within the past. Objective of project is to design a small smart machine that can do the right thing, in the right place, at the right time in the right way. The demand has big considerably for solar electrical power generating systems so inflicting the assembly to rise still. Merely higher output power generation is being needed with a lower cost tag. in order that it will fulfil the wants of small-scale farmers. We have developed a Solar powered harvester with solar tracking system for cutting purpose. Which is simple to operate and cheap in cost also, Eco-friendly since it totally avoids the use of fuels.

KEYWORDS: Agriculture, small-scale farmer, solar tracking system.

I. INTRODUCTION

Agriculture forms the backbone of the country's economy. The agricultural sector contributes most to the overall economic development of the country. For hundreds of years along, the Indian village has been a self- sustaining and self-contained economy. throughout the past forty years, rural reconstruction and development are the most important thrust of economic coming up with, that has caused a fast transformation within the Indian rural economic structure. Some of the major problems in the Indian agricultural are rising of input costs, availability of skilled -laborers. The price of Paddy Harvester available in India is high. So, the middle class people and low class people are affected. The rent for harvester is also high. They want many numbers of laborer and the laborer charge is also high. Ordinary farmers cannot afford it. It takes a lot of hard work to harvest and manual labour takes time and is not effective as they can work for 3-4 hours at a stretch. More-over price of petrol & diesel is increasing day by day, this will not satisfy need of energy requirement of the farming. The vehicle is being developed in the market but not with great efficiency using solar panel. The proposed idea implements the use of dual axis solar tracker using light dependent resistor sensors mounted on solar panel for maximum efficiency containing a crop slider and switch operation for movement of vehicle which will be easy to handle.

II. LITERATURE REVIEW

1. Title-Solar tracker module with automated module cleaning system.

Introduction: Following bullet points which was noticed while reading above article.

- The pursuit of daylight exploitation lightweight sensing element by activating the motor.
- Track the light by using the light sensor microcontroller (ARDUINO).
- IR sensor was added to remove the dust and increase the efficiency of the circuit.
- Sensor less solar panel only needs coding to moves the solar panel.

2. Title-Design and Development of Portable Solar Crop Cutter.

Introduction: Following bullet points which was noticed while reading above article.

- Photovoltaic principle is used to charge the battery.
- Integrating features of all the hardware components.

3. Title- A Review on Solar Operated Agri-Cutter.

Introduction: Following bullet points which was noticed while reading above article.

- Principle of Moving.
- Moving is achieved by the D.C motor.
- From motor power transmits to the mechanism.
- This system requires heavy initial investment.

In India, the conventional methods for agriculture are generally involved which are more complicated and time and labor intensive. The usage of agriculture equipment in the world is increasing. In the usage of agriculture tools, India contributes only 16% according to the survey conducted in the year 2011. This project Solar powered harvester using solar tracker will help us to minimize the human efforts involved in cutting and saves time. This will give perfect cutting with less effort.

III. CONSTRUCTION

The solar operated harvester with tracker system consists of following components.

1. **Frame:** A truss or frame could also be outlined as a structure, created from many bars, riveted or welded along. The frame must be in light weight and able to support all sub-assemblies such as solar panel and battery. This crop cutting machine having dimension 20X20X3 (l × b × h) mm³ is fabricated. For fabrication purpose the mild steel angle section is use to build the frame.



FIG-IV.1 Frame

2. **Cutter Blade:** Cutter assembly consists of slithering and stationary cutter plate. Cutter blade having the dimension 15*3*1.5 inches. The material used for cutter blade is mild steel. In this project the idea is to make the mechanization of small-scale crop cutting machine. The machine focuses to combination of cutting and collecting the crop for small scale farmers.



FIG-IV.2 Cutter Blade

3. **DC Battery:** Sealed lead acid battery with voltage 12v and nominal capability of 7Amp is preowned for the energy storing purpose. The battery usage and maintenance are of free type. The battery is charged throughout the day within the presence of sun i.e., solar power and use once necessary. The battery once charging is often burnt up to 5-6 hrs unceasingly.

4. **Solar Panel:** The solar panel used is of 5watts. Photovoltaic solar panels absorb daylight as a supply of energy to get electricity. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications.
5. **Light dependent resistor:** The resistance for the LDR modifications with the change within the light-weight the quantity of sunshine falls on that is reciprocally proportional to the resistance. With this sort of device, you'll be able to create Automatic light-weight ON OFF system
6. **Gear motor:** 3.5 rpm electric motor that divides a full rotation into a display device is an output device for presentation of information in visual or tactile form. When the input information is supplied has an electrical signal, the display is called an electronic display number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any position sensor for feedback as long as the motor is carefully sized to the applying in relevance torsion and speed. Also geared DC Motor incorporates a gear assembly connected to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as rev per min. The gear assembly helps in increasing the torsion and reducing the speed. One 100rpm,12v motor is used to run the cutter blade. five 60rpm, 12v motors are used for vehicle moving and crop cutting purpose.
7. **Microcontroller:** The high-performance Microchip 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, 3 versatile timer/counters with compare modes, internal and external interrupts, and 5 software package selectable power saving modes.



FIG-IV.5 MICRO-CONTROLLER

8. **Crop Slider:** Crop slider is used to slide crop accordingly once the crop cutting is done. It is driven by DC motor of 60 rpm and mounted on mild steel bar.



FIG-IV.6 Crop Slider

IV. WORKING

The machine is a walk behind type of harvester which can be used for harvesting crops especially fodder crops such wheat, rice, bajra etc. There are two cutter blades; one is moving and another is stationary. The slider crank mechanism is used to convert rotary motion to linear sliding motion. Scissoring action is obtained, due to reciprocatory movement of cutter blade over stationary blade which is used to chop the crops. The frame of the harvester with the dimensions 20 X 20 X 3(b X d X w) inch was fabricated. The frame is fitted with 4 wheels which is driven by 4 DC motors of 60 rpm & 12V. Solar panel was selected instead of diesel engine to drive motor as it is a green & renewable energy source also it needs comparatively low maintenance. LDR sensors are mounted on north south east & west of solar panel so that it can detect the maximum sunlight & move according to the direction of sun. Hence maximum sunlight can be captured in order to obtain maximum efficiency. Unidirectional Diode will be mounted between battery & solar panel to prevent backflow of energy. Battery will be charged by solar panel which is of 12V & 7amp.

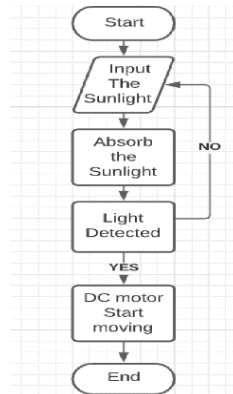


CHART IV.1 FLOWCHART OF WORKING OF SENSOR

Cutter assembly consists of two cutter blade plates. One among the cutter plates is stationary and alternative is slippery in nature. In sliding cutter plate, cutter blade is riveted on 3mm plate and in stationary cutter plate; cutter blade is riveted on 5mm plate. The stationary cutter plate is directly welded and fixed on frame. Sliding cutter blade was supplied with pair of slots of 80mm on its ends; it allowed sliding motion to be in straight line. The top of the sliding cutter plate was connected to the slider crank mechanism. The blades were made up of Mild steel.

Also, Slider will be used which will slide the crops simultaneously and the slider will be driven by 60 rpm motor.

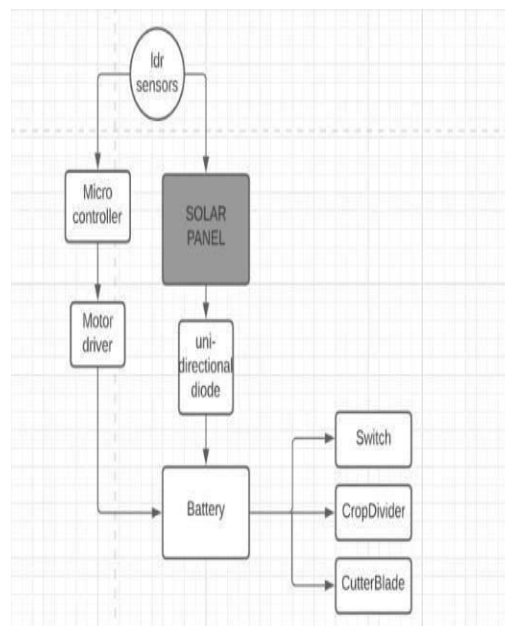


CHART IV.2 WORKING FLOWCHART

FIG-IV.7 FINAL DESIGN

V. ADVANTAGES

1. Low investment.
2. Switch operated machine.
3. Converting maximum solar energy into electrical & mechanical energy.



4. Light weight which can be used by aged and women.

VI. COST ESTIMATION

SR NO.	COMPONENTS	QUANTITY	PRICE(Rs)
1	Frame	1	1200
2	Motor	5(60 rpm) 1(100 rpm) 2(3.5 rpm)	1075
3	Wheels	4	550
4	MS Sheet	1	45

5	Battery	1	1000
6	Microcontroller & motor driver	1	1800
7	Unidirectional diode	1	500
8	Solar Panel	1	750
9	Wooden frame	1	20
10	LDR sensors	4	400
11	Wire & plug	5mtr	150
12	Nut & Bolt	15	50
14	Flange	8	320
15	MS Beam	4 kg	160
16	Spray paint	1	145
		Total Cost	8200

TABLE VII.1 MATERIAL COST ESTIMATION



Sr. no	Operation	Hours	Rate/hours	Amount paid
1	Welding	3	50	150/-
2	Drilling & tapping	3	50	150/-
3	Grinding	2	50	100/-
4	Cutting	2.5	50	125/-
5	Assembly and painting	3	100	300/-
		13.5	Total cost	825

TABLE VII.2 MACHINING COST ESTIMATION

Hence the total manufacturing cost = A + B = 8200 + 825
= 9,025/-

VII. RESULT

CALCULATION

Radius of crank = 40 mm
Power = 5 Watts
Speed(N) = 100rpm

$$0.477 = F \times 0.04$$

CUTTING FORCE (Fc)

$$P = \frac{2 \times \pi \times N \times T}{60 \times 1000} \quad V = \frac{N \times L \times (1+m)}{1000}$$

$$5 = \frac{2 \times 3.14 \times 100 \times T}{60} \quad N = 1000 \text{ rpm}$$

$$m = 1 \quad V = 100 \times 0.38 \times (1+1)/1000$$

Torque, T = 0.477 N.m
Torque = Force X Radius

A comparison of harvesting cost by traditional method along with our harvester is done.

a. Harvesting done by manual process:

Amount paid to the labour for one day = Rs. 300 per day

Total number of labours required in general to harvester the 1 acre farm of rice in a day = 12

Total amount paid to the labour = 12 X 300 = Rs. 3600 per acre in one day. Therefore,

total expenditure in one day is = Rs. 3600 + 1000 (Lunch) = Rs.4600

b. Harvester done by machine:

Design, Development and Fabrication of a Compact Harvester Total cost of Electricity for acre farm for a day = 27Rs.

Amount paid to the labour = 300Rs.



But we are converting solar energy into electrical energy which is totally free of cost since it is directly a natural resource.

So, we should neglect the cost of electricity as well. Therefore,

Total expenditure = amount paid to the labour + Maintenance Total expenditure = 300 + 50
= 350 /-

Amount saved by using the harvester = 4600 – 350
= 4250 /-

VIII. CONCLUSION

The top concentration of our design is the cost and operational ease in case of small-scale farm units. This machine is formed to reduce the harvest rate of the crop. This machine fulfilled all objective and following conclusion were drawn on based on performance:

1. Based on the overall performance of the machine we can definitely say that the project will satisfy the need of small-scale farmer, because they are not able to purchase costly agricultural equipment.
2. We are not using fuel and petrol so work is done with less investment.
3. This is the switch operator machine, so the machine required less man power and less time compared to traditional methods.

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