A Review on Development of Solar Powered Multi Crop Cutter for Harvesting

Pathak, T. N.[1], Vidhate T.R.[2], Jadhav S. S.[3], Thakur S. D.[4], Prof. Vadnere A. P.[5], Prof. Kothawade V. E.[6]

1, 2, 3, 4 – Final Year Diploma Students in Mechanical Engineering, MET's Institute of Technology, Nashik

5- Project Guide and Head of Department, Mechanical Engineering, MET's Institute of Technology, Nashik

6- Lecturer in Mechanical Engineering, MET's Institute of Technology, Nashik.

Abstract:

This paper represents the project work carried on development of solar power crop cutter. We have developed a compact mechanism for harvesting of crop cutter work on solar power so that we can an easy harvesting in minimum period of time. This set up is used to cut the multi-crops at a time, which help the small scale farmers. This cutter is been invented because of low cost, high compatibility, and use for rough use. This set up uses the solar power, which is provided with different blades, solar plate, rubber wheel, DC motor and battery arrangement which results in transmission of this solar power into rotary motion of cutter at the end of which the crops get cut easily and perform various task as per requirement. We have made changes in the existing machine to make its application easier at reduced cost. Our main aim in Cost and pollution control is attained through this Project work.

Keywords: **Crop Cutter, Harvesting, Solar Panel, Rotary motion etc.**

I. INTRODUCTION

The basic objective of this project work is to develop compact multi- crop cutter operated on electric motor running through a solar energy. By implementing this project we can eliminate a lot of difficulties in agriculture sector. Power plays a great role wherever man lives and works. The living standard and prosperity of any nation vary directly with the increase in the use of power. The electricity requirement of the world is increasing at an alarming rate due to industrial growth, increased and extensive use of electrical gadgets.

In this context, today's, best alternative source is solar energy. A solar powered Multi Crop-cutter was developed on the principle of grass mowing. The sun provides sustainable amount of the energy used for various purposes on earth for atmospheric system. The total solar energy is estimated to be 30,000 times greater than the total annual energy of the world [8]. The solar powered Multi crop-cutter is based on the same principle that other early inventions of crop-cutter works on. It uses the Flat plate solar collector to generate the energy needed to power the mower. It is assumed that a crop-cutter using solar as the energy source will address a number of issues that the standard I C Engine and crop-cutter worked on electric motors do not. A crop-cutter with solar energy will be easier to use, it eliminates down time and also it is user friendly.

Solar powered Multi-crop cutters can be described as the application of solar energy to electric energy converted and applied to motor which revolve a blade which does the cutting of crop. Solar energy is the renewable energy. We are developing such crop cutter which has easy to use. We are going to use solar energy to generate power which is stored in form of battery. This supply is distributed in all section as per our requirement. Using Flat Plat Solar Collector panel generate the energy needed to power the cutter. The dangerous emissions produced by the gasoline spillage in that of the I C Engine into the atmosphere are also eliminated.

II. LITERATURE REVIEW

Sachin M Moghe and et al; produced a flywheel motor with a concept of human powered mini paddy harvester is efficient as compared to modern harvesters. The battery charge due to peddling mechanism is also used for many electrical applications. [1]

Dr. U. V. Kongre and et al; introduced a new type of modified cutter which can reduce dependent to workers which give much effect in maximizing the profits to the farmers. The work was carried out with objective to design modification and evaluate the performance of manual operated reaper. [2].

Zakiuddin K.S and et al; explained about the human powered flywheel motor concept which contain Bicycle,

Chain, Gear pair, Flywheel. The importance of human power for the earliest time to the present and its necessity to different machine with future scope. [3].

Pedersen S. M. and et al; researched on autonomous system for grass cutting, crop scouting and autonomous weeding which reduce labor costs and restrictions on the number of daily working hours significantly.[4]

Robin Burgess-Limerick and et al; explored the design of sugarcane harvesting machines and identifies the design modifications undertaken by field maintenance staff to improve several issues of the equipment. [5].

Akshay Komawar and et al; developed and performance of human powered multi-crop cutter so that it can easy harvesting in minimum period of time. It has bevel gear mechanisms which results in transmission of this manual motion in rotary motion of cutter at the end of which the crops get cut easily without any hard effect. [6].

A. K. Pitale; gave detailed information about process structure for solar powered multi-crop cutter. They develop pedal mechanism or human powered motor such as cloth, chaff cutter, potter's wheel, crop cutting. They also introduced some solutions to improvise the crop cutter that they developed. [7].

III. PROBLEM IDENTIFICATION

As we know, India is an Agriculture based country and the agriculture is the major source of income of many peoples of India, which, needs to concentrate in some aspects like how to increase productivity and profit, how to reduce cost and how to solve and ease the problems of farmers. [8]

To overcome this new Solar powered operated cutter is fabricated for cutting of multiple types of crop during harvesting and named as "Solar Powered Multi-Crop Cutter". It possesses five criterion ease in manufacturing, ease in handling, low cost, light weight and no pollution (Eco-Friendly).

[1] Now a day's pollution is a major issue for whole world. In case Gasoline crop cutters due to the emission of gases its result gives pollution.

[2] Also, recently in rural areas, has seen a shortage of skilled labor available for agriculture. Because of this shortage the farmers have transitioned to using harvesters. These harvesters are available for purchase but they are not affordable because of their high costs, however, agriculture groups make these available for rent on an hourly basis.

[3] Due to financial or transportation reasons these combine harvesters are not available in all parts of rural area. Thus, there is a need for a compact and efficient harvester which would be considerably cheaper and also more accessible.

[4] Thus, the objective of the project work is to create a portable, low cost mini harvester which will be user-friendly.

[5] The price of fuel is also, rising hence it is not efficient and economical. So the Solar powered crop cutters are introduced.

All these problems mentioned above, gave us the basic idea about what was required in the current situation. The idea was to create a machine which will reduce the labor required to harvest crops and which is cheap and compact. This machine has the capability and the economic value for fulfilling the needs of farmers [9]. This machine is cost effective and also easy to maintain and repair for farmers.

IV. DESIGN OBJECTIVES

[1] To manufacture a Multi crop cutter operated on solar power for the ease of cutting crops at higher rate.

[2] To simplify the complex driving mechanisms used in earlier projects and giving it simple and high working capability.

[3] To carry out the complex crop harvesting easily and without emission.

[4] To achieve crop harvesting process at cheaper side.

[4] Another objective of the project was learning how to work the different parts of crop cutter and achieve its optimum working.

V. METHODOLOGY

The solar powered multi-crop consist of a base frame, supporting frame, DC motor, solar panel, switch, electric wiring, battery, wheels and sharp blades. All this components are mounted on a frame, along with wheels are fitted to this frame. The movement of this harvester is done by pushing i.e. by using human powered. This crop cutter is highly efficient as it works on solar powered and it is affordable to small farmers due to its simple working. The advantage is it does not require any maintenance, easy to handle and it can cut different crops with the help of simple height adjustment by nut and bolt mechanism. Working of the crop cutter takes place stepwise. The crop cutter comes

to rest momentarily after each step. The seven steps of crop cutting are,

1. Battery connection gets ON.
2. By human effort move the cutter in desired direction.
3. Through the power of battery cutter starts rotating.
4. Cutter cuts the crop and throws it aside.
5. Cutter cuts the crops and works desirably.
6. After discharging of the battery it is again charged with the help of charging adapter.
7. Battery can be also charged with the help of solar energy from solar panel.

Table 1: Operation Performed by Multi Crop Cutter

S. N.	Operations	Synthesis
1	**Crop Cutting**	Process of gathering a ripe crop from the fields and removing it from its stems or root for utility.
2	**Land Leveling**	Land leveling is the process in which the land lateral irregularities are removed and made flat.
3	**Trimming**	Cutting small pieces of unwanted grass or crops to remove them

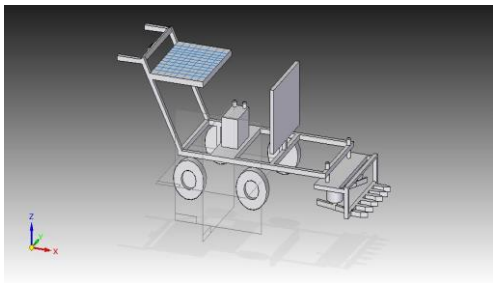

Figure 1: 3D Modeling (Solid Edge) and Actual Image of Multi Crop Cutter

Table 2: Component Specifications

S. N.	Components	Function & Specifications
1	**Battery** 	The multi-crop is powered by two 12 V (VRLA) DC motor, each motor drives the cutter; these motors are fixed by weld as well as nut and bolt attachment with a frame. And each motor is powered by 12V Lead Battery.
2	**Wall Adapter** 	**12 V AC/DC** An AC Adapter or recharger is a device used to put energy into a secondary cell or rechargeable battery by forcing an electric current through it.
3	**Brushed DC Electric Motor** 	A brushed DC motor is an internally commutated electric motor designed to be run from a direct current power source.
4	**Flat-plate-collectors** 	A **solar** flat plate **collector** collects heat by absorbing sunlight. A **collector** is a device for capturing **solar** radiation. **Solar** radiation is energy in the form of electromagnetic radiation from the infrared (long) to the ultraviolet (short) wavelengths.
5	**Manual Control by Switch** 	The control system of the Model is very simple. The whole electrical circuitry has consists, switch, connecting Wires, battery and Motors as load.
6	**Frame** 	Cast iron frame for the support of all sub-assemblies such as solar panel and Battery. The motor drives the intermediate shaft is attached to the platform by a clamp attached to the iron frame by nut and bolt attachment.

Coming to the working of solar powered Multi crop-cutter, it has panels mounted in a particular arrangement at an angle of 45 degrees in such a way that it can receive solar radiations with high intensity easily from the sun. This solar panels convert solar energy into electrical energy as studied earlier. Now this electrical energy is stored in batteries by using solar chargers. The main function of solar charger is to increase the current from the panels while batteries are charging, it also disconnects the solar panels from the batteries when they are fully charged and also connects the panel when the charging in the battery is low. The motor is connected to the batteries through connecting wires. Between these two mechanical circuits breaker switch is provided. It starts and stops working of motor. From this motor, the power transmits to the mechanism and this makes the blade to slide on the fixed blades and this makes to cut the crop.

VI. PERFORMANCE SUMMARY

Advantages:
[1] It is real time operating system.
[2] The system is non-programmable.
[3] Light in weight, and easy operating.
[4] Purchase and operating is very less.
[5] Can be operated by unskilled person.
[6] It does not require high maintenance cost.

Limitations:
[1]Battery is most important for duster and water pump operated.
[2] Charging through solar panel will be affected by atmospheric conditions.

Applications:
[1] It can be used to harvest the agricultural field.
[2] It can be used to remove the unwanted crops or grass.
[3] It can be used in small farms where productivity is more.
[4] It can be used in farms where there is no availability of labor.

VII. CONCLUSIONS

To conclude, we believe that the project was a successful one since we could meet most of the targeted requirements with pleasant team management. The terms stated at the beginning stage was accomplished with a rather simple design which maintain throughout the project. We hope that the experience learned from the project, including the planning in the designs and the skills in utilizing different tools could help develop our career path in the future.

The Development of Solar powered multi-crop cutter was an important aspect of this study because a strong interaction between the different parts was needed. So we are satisfied with our project work. The basic objective of this project work is to cut the crops/harvest in optimum manner without failure.

Beside these, following objectives of project work are getting fulfilled;
[1] We successfully manufactured a solar powered multi crop cutter for the ease of cutting crops at higher rate.
[2] We simplified the complex driving mechanisms used in earlier projects and giving it simple and high working capability.
[3] We carried out the complex crop harvesting easily.
[4] We achieved crop harvesting process at cheaper side and eco friendly.

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