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Development of Multipurpose Agricultural Cutter

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Abstract - Today, Agriculture especially in India need to concentrate in some aspects such as how to increase the productivity and profit how to reduce the cost and how to solve the problem comes from workers. To overcome these, a new solar powered motor cutter is fabricated specially for cutting various crop varieties during the time of harvesting and named as an MULTIPURPOSE AGRICULTURE CUTTER. It comprises of three criterion such as "easy to fabricate, low cost and lightweight" With this multipurpose agriculture cutter, the entire problem can be solved easily. There are some procedures involved in fabricating this device such as fabricating the prototype using suitable material and test the functioning of this machine. So the objectives are to fabricate and test the performance of the prototype of a solar powered motor crop cutter for harvesting the crop.
Keywords - Productivity, Crop Cutter, Fabricate, Harvesting

I. INTRODUCTION

Agriculture is an important part of the Indian economy and culture, and it can play an important role in distributed generation of energy. This project concept identifies the opportunities for solar energy use in agriculture. Farmers have the tradition of being stewards of the land, and their investment in renewable energy supports their role of protecting the land, air, and water. Solar energy, like other renewable, offers an opportunity to stabilize energy costs, decrease pollution and greenhouse gases (GHGs), and delay the need for electric grid infrastructure improvements. Solar energy systems have low maintenance costs, and the fuel is free once the higher initial cost of the system is recovered through subsidies.

In agricultural fields or in nursery or even in house hold growing grass, grass is commonly found problem. Removal of the grass is also a tedious job involving lot of human efforts. In the modern world as time for carrying out many thing has reduced drastically so as to be done the removal of grass involving use of a machine. This machine can be railed as multipurpose agriculture cutter which is mostly depends on the type of blades that we use to cut the crops.

It is a simple in construction where a very high speed motor and cutting blade is connected to an end of a holding rod that is held with hand, to the free end of this rod a battery is attached. Also a solar panel is attached to other end to charge the battery there by making the multipurpose agriculture cutter run with the help of solar energy.

The cutter used is actually a flexible blade that cuts the crops with high speed rotation. The high speed rotation of the blades along with the centrifugal force acted on it due to its minimal weight enable the flexible blades to cut the crop easily despite being not any hard and Sharp material which is generally associated with any cutting blades.

A. Problem Identification

In our country most of the work associated with agriculture done with manually as entirely. This Situation change after the some year when peoples came to know about the machinery. They start to use such machines which are for agriculture purpose. The different types of effort less machines now are in markets .some of them are really helpful to the farmers but, machine used for the cutting ,harvesting are all are based on the conventional energy and such machines are not Eco-friendly. Because the fuel used for these is polluting the environment and the deflection of the fuel is the most important problem will face in coming days.by taking care of all such problems the conventional energy is replaces with the non-conventional energy. The petroleum based brush cutter is not Eco-friendly. The use of renewable source reduces the operation cost compare to the petroleum fuel for the agriculture applications

II. LITERATURE SURVEY

This chapter deals with research work done in past by various authors on crop cutting machine is an essential tool for the maintenance of yards. They vary in size, mode of operation, and power. The power source riding movers for example are usually powered by a gasoline engine and are ridden and steered by the operator. Walk behind movers are designed to be pushed by the operator and typically run on gasoline or electricity. Modern gas powered and electric powered lawn mowers cut grass with a single blade revolving at a high speed parallel to the ground. The blade is slightly raised along its rear edge to create draft that lifts the cutting blades before its cutting operation.

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A. Literature on Agriculture Products

1) "Chiu -Fan Hsieh" in his paper titled "The effect on dynamics of using a new transmission design for eccentric speed reducers" has stated new transmission design for eccentric speed reducers that differs from that used with a traditional cycloid speed reducer. This paper proposes a new transmission design for eccentric speed reducers that differs from that used with a traditional cycloid speed reducer, but we thought of making in simple manner as its maintenance cost is high [5].
2) "Ketchpel , 'Jr. et al " in his paper has stated that, A shear for grass and the like includes a tooth plate on which is pivotally mounted a plurality of shearing members, each including a narrow and resiliently deformable blade element. As we are making a multipurpose cutter we just had a glance about the cutters in his paper. [6].
3) Siddaling et al, The project titled "Design and Fabrication of Small Scale Sugarcane Harvesting Machine". In this paper we studied about the 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.Hence this project work overcomes these problems and aims to develop a small scale sugar cane harvesting machine. And this machine is easy to operate, low cost with more efficiency and having less maintenance. The machine is helpful for farmers and it is economical.[7].
4) Ganesh et al, the paper entitled Low Cost Mechanical Aid For Rice Harvesting. In this paper we studied about the machine with a modified bush cutter. A metal plate and rubber guard assembly was fitted the blade on the handle to guide the cut stalk to the left side. The machine performed well in the field conditions with a field capacity of 0.5 acre per day consuming 0.25 liters of fuel in an hour. This machine should be affordable to low income farmers in developing countries.[8].
5) P.B.Chavan et al, The paper is titled as Design And Development Of Manual Operated Reaper. In this we studied about harvesting operation to the small land holders for harvesting varieties of crop in less time and at low cost by considering different factors as power requirement , cost of equipment , ease of operation , field condition , time of operation and climatologically conditions. The operating, adjusting and maintaining principle are made simple for effective handling by unskilled operators.[9].

III. METHODOLOGY

A. Design

The design of multipurpose agriculture cutter can be extended for cutting paddy, weeds, and lawn grass etc., by using solar powered motor . In present days the Concept and Technology employing this Non-conventional energy becomes very popular for all types of development activities. Finding solutions, to meet the "demand of Energy" is the great challenge for Social Scientist, Entrepreneurs, Engineers and Industrialist of our Country. According to them, use of Non-conventional energy is the only alternate solution for conventional energy demand. There are many applications in Agriculture Sectors. Multipurpose agriculture cutter which can be used for finishing work as well as for cutting long, thick grass, brush. Its have been carefully designed for user comfort by considering ergonomics aesthetics. Particular attention has been given to avoid the pollution and worker tiredness.

B. Components of Solar Type Cutte

1) Solar panel
2) DC Battery
3) DC motor
4) Cutter blade
5) Handle
6) Wind rowing system (bucket)
7) Covering Shield
8) Hollow rod

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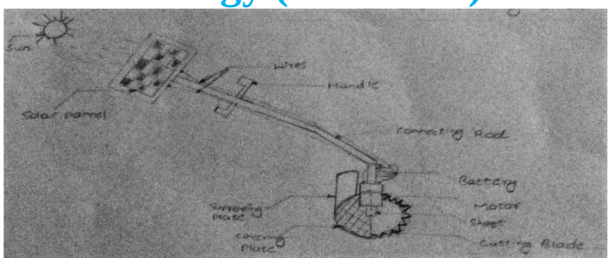

Fig.3.1 Solar Type cutter

C. Solar panel

1) *Photo voltaic principles:* The photo voltaic effect can also occur when two photons are absorbed simultaneously in a process called effect. The photo voltaic effect is the creation of voltage or electric current in a material upon exposure to light and is a physical and chemical phenomenon., the electrons present in the valence band absorb energy and, being excited, jump to the conduction band and become free. The chemical bonds of the material are vital for the process to work, as crystallized atoms are ionized and creates a chemical electric imbalance, driving the electrons. The standard and obvious photo voltaic effect is directly related to the photoelectric effect, though they are different processes. When the sunlight or any other light is incident upon a material surface These highly excited, non-thermal electrons diffuse, and some reach a junction where they are accelerated into a different material by a built-in potential (Galvani potential). This generates an electromotive force, and thus some of the light energy is converted into electric energy. A solar cell consists of:

a) Charge collecting back and front electron

b) Semi-conductor in which electron hole pairs are created by the absorption of incident solar radiation.

c) Region contracting a drift filled of charge separator

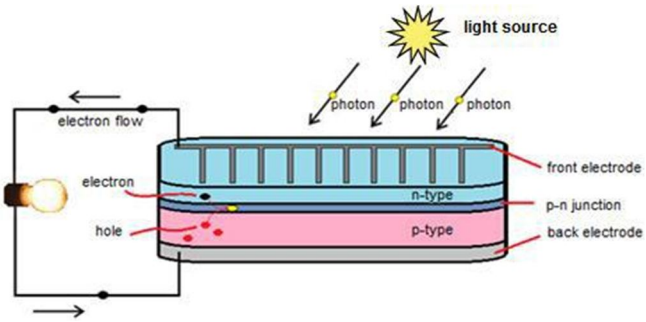

Fig.3.2 Photovoltaic effect principle

2) *DC Battery:* Sealed lead acid battery with voltage 12v and nominal capacity of 7Amp is used for the energy storing purpose. The battery usage and maintenance is of free type. The battery is charged during the day in the presence of sun i.e, solar energy and use when necessary. The batter after charging can be used up to 5-6 hrs. Continuously.

3) *DC Motor:* The motor used for the controlling the cuter, the permanent dc motor with 12V is used having the speed 1800rpm. this single phase motor work on the Fleming hand rule and generate electric current and this electric current converted to mechanical work like to rotate the blade and cut the brush.

4) *Cutter Blade:* Different types of blades are used for operation to be done and these blades are made by cast iron, Stainless Steel, carbide steel. We are using Tungsten cutter blades for cutting purposes: The rotation of blade gains the cutting action.

operations: weed cutting, grass cutting, paddy Cuttin

5) *Handle:* It is the support to hold the equipment by the user and operate the multipurpose cutter.

6) *Win Rowing System:* This is used for collecting the cut bush and putting it side.

7) *Covering Shield:* It is mounted on the blade and acts as a shield to blade as well as protect the excitation of cutting grass towards user.

8) *Stand:* The stand is used for the assembly of the all the component. Stand supports used in high or low temperature applications may contain insulation materials. The overall design configuration of a stand support assembly is dependent on the loading and operating conditions.

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D. Specifications

Fig.3.3 Solar Panel

1) Solar Panel

a) Solar Panel : Panel Size : 0.235m x 0.175m

b) Cost of the Panel : Rs.450/-

c) Weight of the Panel : 850g.

2) DC Battery

a) Weight of the battery : 1kg

b) Output power : 84 watt

c) Operating voltage : 12v

d) Current : 7 Amp.

3) DC Motor

Fig.3.4 Motor

a) Weight of the motor : 250g (approx)

b) Operating power required : 82 watt

c) Operating Voltage : 12V

d) Motor Speed : 1800 rpm

e) Operating current : 7 Amp.

4) Cutter Blade

Fig.3.5 Blade

a) Material : Tungsten Carbide Diameter : 110 mm,

b) Kerf - a slit made by cutting with a saw :2.0 mm,

c) Bore : 20 mm,

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d) Teeth: 30 T.

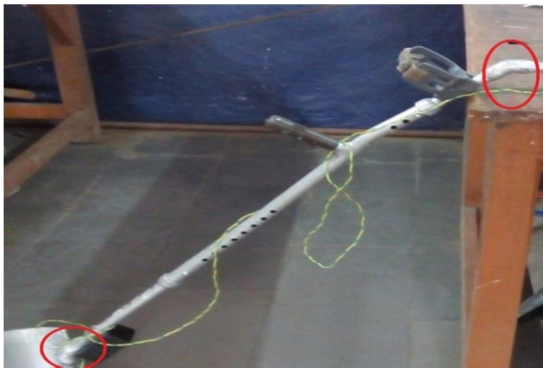

Fig.3.6 Couplings

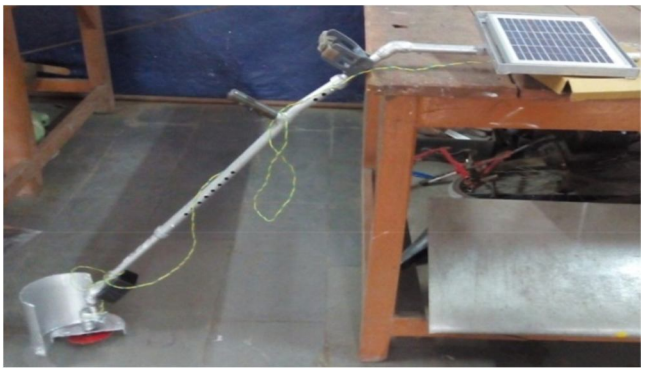

Fig.3.7 Final Assembly

IV. CALCULATIONS

Power Conversion Efficiency: The Solar cell Power Conversion Efficiency can be calculated by using the relation,

$$\frac{Pmax}{\text{Pmin}} = \frac{\text{0}utput\ Power}{\text{Input}\ Power}$$

Where,

$P_{min.}$ = Incident Solar radiation x Area of the Solar Cell in = I_T x A

A. Performance data measured at (STC) Standard Test Condition (1000 W/ m^2; 1.5Amp; 250^0C)

B. Maximum Voltage at Peak Power (Vmp) : 16.4 V

C. Maximum Current at Peak Power (Imp) : 3.05 A

D. Peak Power : 5 Wp

E. Open Circuit Voltage (Voc): 21V

F. Short Circuit Current (Isc): 3.45 A

1) Power Rating:

a) Voltage : 16.4 volt

b) Current : 3.05 Amp.

c) The output power ($P_{max.}$) = V x I out Power : 16.4 x3.05 = 50 watt.
It is the power delivered from the motor.

2) Testing of Charging Time:

a) Instrument used to measure Sun Radiation : Sun Meter The Sun Radiation are measured in : W/ m^2

b) Required voltage for charging the Battery : 12 volt.

3) Time Measurement:

a) When the Solar radiation is between 200 to 300 W/ m^2 : 6 to 5 hrs.

b) When the Solar radiation is between 300 to 400 W/m^2 : 4 to 3 hrs.

c) When the Solar radiation is between 400 to 600 W/m^2 :2 hour. Running period : 2 to 3 hours.

V. CONCLUSION

This multipurpose agriculture cutter is the replacement of the petrol/diesel engine cutter present in market. The solar powered agriculture cutter is the implement in petrol engine .This cutter is totally Eco -friendly and is so useful to the people for multipurpose also. The cost of the system is reduced because the use of solar energy in the replacement of the conventional fuel energy. These cutter is more suitable to the people for the cutting purpose because of is easier handling. The common man can also offers this because of its advantage like less cost, pollution free ,easy to operate ,time saving and no waste. But compare to all parts of cutter assembly solar panel is costlier and at present in order to curtail global warming and ozone depletion, the government of India offering subsidy for solar equipment to avoid such effect on environment, so in present days it is expected to operate of machineries by using solar energy. The panel use for this is not much costly, it can save more fuel and the money which is for the fuel purchase. The maintenance and operating cost also reduces in this way the solar powered multipurpose agriculture cutter is completed successfully within the working

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days of the project.

VI. FUTURE SCOPE

Man is always trying to develop more and more modified techniques with increasing the apathetically look and economic consideration. Hence there is always more and more scope towards whatever he might have created of course after having the experience of the presently manufacturing things. Being engineers and having ability to think and plan but, due to some time constraints and also due to lack of fund, we only have thought and put in the report the following future modifications:

A. By using the cutter blade with high strength we can increase the power used, the cutter can be used for many applications in agriculture sector like tree cutting, shrubs cutting, cane cutting, maize cutting etc.

B. To avoid the limitation like cloudy and dark environment, the solar charger can used.

C. The adjustment for the folding of stand can be done for transportation point of view.

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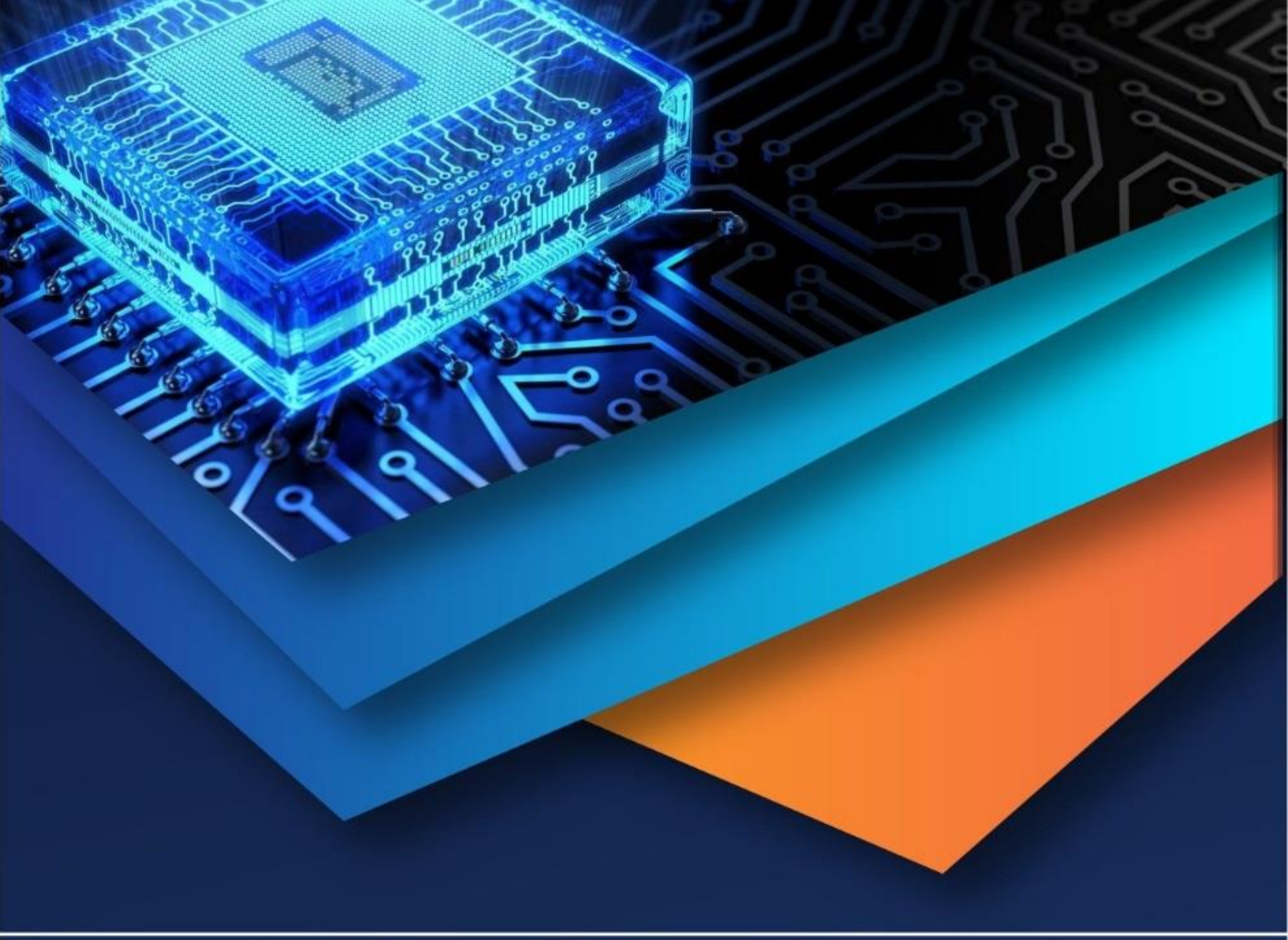

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