Electric crop cutter powered by solar energy

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Abstract

Harvesting of crop is one of the important operation which demand considerable amount of labour. The availability and cost of labour during harvesting season are the serious problem. To avoid this problem, researchers introduced the harvesting machine which is run by fuel and it is very costly and not eco-friendly. To overcome the drawbacks of existing model like pollution due to the fuel and the fuel cost, Now we introduced the Remote control solar powered harvesting robot which is four wheel drive and the system was used batteries to powered the vehicle moment of motors as well as harvesting blades motors and the solar panels is used to charge the batteries.

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). Solar energy systems have low maintenance costs, and the fuel is free once the higher initial cost of the system is recovered through subsidies.

Recently ruler has been a shortage of skilled labour 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 hourly basis. But the small holding farm owners i.e., generally having land less than 2 acres generally do not require the full-featured combine harvesters. 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 small and efficient crop cutter which would be considerably cheaper and also more accessible. The mission is to create a portable, low cost mini cutter and user friendly. These problems gave us the basic idea required to cut the crops and which is cheap. This machine has the capability and the economic value for fulfilling the needs of farmers having small land holdings which is less than 2 acres. This machine is cost effective and also easy to maintain and repair for farmers.

Present state:

There are two ways of crop cutting process

1. Manual process or with help of sickle.
2. Mechanized motor process.

Fig :Manual Cutting of Chickpeacrop

In a manual process the crop cutting is done with the blade hampering on the crop or sack containing the crop or with the help of rotary equipment which is very tedious work. Which is cut the crop, Whilst in the motorized process the motor used in this process for to cut the crop with the help of cutter blade to cut the crop .the power transfer and power done with the help of motor through suitable mechanism. If one carefully observes the first process then he could find the following limitations which are given below

This process renders fatigue to the hand; it produces damages to the hands As it is continuous process it requires monotonous work.

It is time consuming and laborious process so no one wants to do in today era. On the other side, in the second process following limitations have been found out which are discussed below,

1. The requirement of electricity is prerequisite for this process. As today's main problem is the power crises and load shading and the machine becomes idle in that case.
2. The cost of the machine is quite high and the rural people could not afford it to buy.

PROPOSED SOLUTION

A crop cutter is a mechanical device used to cut the crops like rice, paddy, wheat, chick pea Bengal gram and some other crops in order to reduce the burden to the farmers and the time consumption. This crop cutter makes cutting the crops with minimum efforts. In Indian farms generally two types of crop cutting methods for crop cutting , they are manually crop cutting by using hands and fuel operated crop cutting machines , out of which fuel operated crop cutting machines are mostly popular. To cut the crop, so many cutting machines are introduced which are run by fuel and these are very costly. Due to this crop cutting machine costly, farmers preferred the manually cut the crop. But due to this, farmers require a no. of skilled labour and increase the time consumption. To overcome all these disadvantages, A Solar Operated crop cutting machine is introduced and it is less costly and maintenance free, hence is affordable to the farmers. Therefore a solar operated crop cutter is designed and fabricated.

This system can be operated using solar energy or electrical energy. The solar energy is converted into electrical energy and is stored in a battery. The main advantages of the present

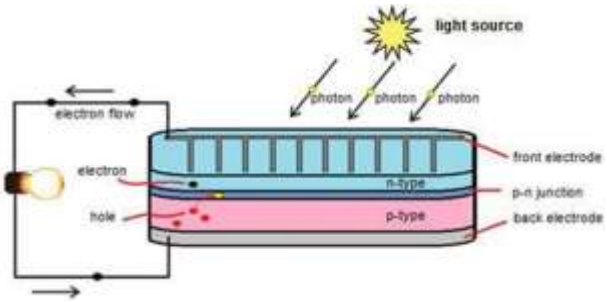
system are the running cost reduces to minimum and consumes less time.

Solar energy from the sun is harvested on the solar panel. The panel is made up of photovoltaic cells, which converts photon energy to electric energy. These cells are made up of silicon semiconductor. Solar panel is used to generate electric energy and charge the battery. The charged battery is used to operate the DC motor for cutting the crop.

Fig: Solar powered crop cutter

Solar panel:

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

Fig : Photovoltaic effect principle

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

1) *DC Battery:* Sealed lead acid battery with

2) 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) *PMDC 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.

Working:

The system consists of solar panel, charging controller, battery, dc motors and motor controller, harvesting blades. The solar panel delivers an output in the order of 12 volts and 40 watts power to the charging unit. The charging unit is used to strengthen the signal from the solar panel. The charging unit delivers the signal which charges the battery. According to the charged unit, the Dc motor operates, such that harvesting blades works. When the sun rays are falling on the solar panel electricity will be generated through the solar cells and stored in the battery. By the electric power in the battery the wiper motor operates then the harvesting blades moves then cut the crop. The battery is connected to the motor controller and then motor controller is coupled to the remote controller. Through remote controller, we control the movement of the vehicle. There is no maintenance cost and operating cost as it is using solar energy and no pollution problem. Its working principle is very easy and it is economical for the farmers, which has one more advantage that it can also generate power that power is saved in battery.

Calculations:

Diameter of the Chain sprocket = 5.5 cm

Distance between the wheel chain sprocket and motor chain sprocket =15 cm

Speed ratio = Motor chain sprocket tooth : wheel chain sprocket tooth=18:18 = 1:1

Battery Voltage = 12V

Capacity of the Battery = 7A-h

Total power = 84W

Solar Panel Rated power = 40W

Charging time ,when the battery is empty = powerof the Battery/ Rated power of the solar panel = 84/40 = 2.1 hrs

Voltage of the Wiper Motor = 12v

Current in the Wiper Motor = 1.5 A

Power in the Wiper Motor = 14 w

Speed of the Wiper Motor = 20 RPM

Torque of the Wiper Motor = 25.33 kg-cm

Voltage of the DC gear Motor =12v

Current in the DC gear Motor= 0.9 A

Power of the DC gear Motor= 7W

Speed of the DC gear motor= 30 RPM

Torque of the DC gear motor =14.53 kg-cm

Total current drawn from the battery for 1 hour= Wiper Motor+ 2 DC gear Motor = 1.5+(2*0.9) =3.3 A

Total battery Discharging time= Battery capacity/ current drawn from battery= 7/3.3 = 2.12 hrs

Angular speed of the DC gear motor=$2*3.14*N/60$= 3.14 RPM

Linear speed of the Wheel connected to DC gear Motor = Radius of the wheel * Angular Speed = 1mt*31.4=31.4m/s

To complete one acre of 4046 m^2 it takes 2.5 hrs

Conclusion:

This agriculture crop cutter is the replacement of the petrol/diesel engine cutter present in market. The solar powered agriculture crop cutter is the implement in petrol engine .This cutter is totally Eco - friendly and is so useful to the people . 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 crop cutter process is completed successfully within the working days of the project.

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