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Construction of Solar Powered Agri Weeder

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Abstract: Lawn Agriculture plays a vital role in Indian economy. The reason behind reduction in the productivity of agricultural is weeds. Weed removal is serious problem faced by the farmers that will reduce the farmer interest to continue cultivation. The main objective of this paper is to construct and develop a solar powered weeder to provide the best opportunities for cultivation. The working of this project is depends on the solar panel. This is motorized equipment driven by the solar energy which moves blades to cut the weeds by chain sprocket mechanism. The design is simple and easy to operate. This equipment is designed to minimize the human effort.

Keywords: Solar weeder; weeding efficiency; field capacity; different speed.

I. INTRODUCTION

Weeder is a mechanical implement used to take away the unwanted plants in the field. Indian agriculture is reliant on human power and also animal power. It is a time-consuming process. Most of the Indian farmers are having small agricultural land. Farmers still follow the conventional methods in the cultivation for weeding purpose. These methods require high labor force to perform the operations.

The main disadvantage of the modern equipment is its cost effectiveness because most of them are mechanized and driven by fuel. So, they can hardly afford such costly equipment's. Single row weeder was developed for weeding purpose but are not used widely in the agricultural operations. This is because lack of awareness on the newly invented single operated weeders. Weeding operation was done mostly by the hands.

The weeding performance of the hand tools are good but mostly time consuming. These tools may have the chances of injuring the performer. The different postures of the workers have been studied on the basis of their working conditions on the field. Agriculture is not an easy task which includes different stages. Different working postures have been studied to develop an ergonomically suitable weeder for workers. Different types of weeders have been studied to understand the weeders in a better manner.

The comparisons of the weeders helped to understand the present weeding tools which perform better operation. But mostly fuel operated weeders are available in for the wet land cultivation. The performances of the equipment's are efficient but the fuel rates are going up in the present situations. Soli tillers and weeders are non-traditional tools used for weeding. The mechanical implemented tools play major role in the weeding process helps to achieve the high productivity of the crops yields but they are labor intensive.

In order to overwhelm this, a new type solar powered rotary weeder is designed based on mostly available nonconventional energy. This motorized agricultural equipment works with the support of blades that breaks the soil to cut the weeds. This machine helps to minimize the expenses caused by labor and fuel.

This equipment is a type of agricultural weeder operated with the utilization of solar power. The drive mechanism of this machine includes one solar panel, one electrical dc motors, two batteries, rotary blades and chain sprocket mechanism. One electrical dc motor is connected to the wheel of the machine with the help of chain sprocket mechanism. These mechanisms transmit the power from the motor to the shafts of the wheel. In this machine J-type blades will be used. This shape of blades mainly used for tilling hard soils such as dry lands. These blades are attached to the rear end at the roots of weeds and are pulled by one electric dc motor and main wheel. The motor is connected to the two batteries in series. Batteries are connected to the solar panel. The solar radiation immersed on solar panel. By this process the generated solar energy is converted into electrical energy. This energy is stored in batteries. This stored energy is supplied to the dc motors when they needed through which the wheels and weeder blades are rotated. The motor speed is varied by altering the operated voltage output through the speed controller.

1) Block Diagram

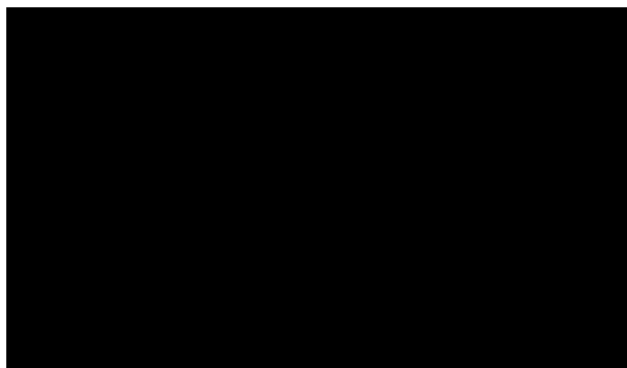


Fig. 1. Block Diagram For Project

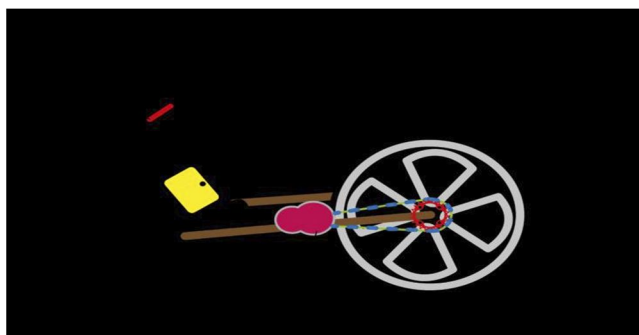
The block diagram represents the actual working of project i.e., representation of each module of project and its linking with others is been given to accomplish the main aim of fabrication of solar powered agri weeder.

The first block deals with the trapping of available renewable energy by help solar panel as India receives fair amount of solar energy throughout the year and is available in ample amount. The solar panels are used to trap the same energy and convert it into useful electrical energy form the block represents the same use of solar panel as main source of power.

We also have a supply and charging unit which has a job to Buck-Boost the power levels incoming from the solar panels required to charge the battery bank, also it doses job of providing various voltage levels for circuit components operations. The backup and battery bank contains the battery for storing charge for night time or when the solar energy is not readily available. Status panel is provided to display all of the online parameters of the e-weeder to get better information bout the system ongoing conditions for various efficient tweaking. The user control panel is for adjustment of system or machine input to set the fabricated machine for desired output in most efficient and optimized way.

In the Maine drive system instead of going for a IC engine or fossil fuel based system we are intended for a Electric based drive system due to its economical, efficient and non-polluting benefits over traditional system. Hence to accomplish that we went for a DC Brushed motor-based drive system represented as the central link of the block diagram. In which the relay module is just a electromechanical switch for control of main power supply of drive in case of emergency switch off condition due to failure or raise of abnormal condition. Following which we can there is a electronic speed controller which uses a better improved version of Brushed Speed Controller with inbuilt filters for better and harmonics free control of the DC motor used it has its own PWN signal generator which drives a High Switching Speed MOSFETS based bridge circuit to control the output voltage and current supplied to the main motor. The desired speed is obtained by a electronic Potentiometer based durable accelerator which gives feedback to the ESC for desired levels of voltage and rrent. The main motor used is a PMDC motor that is Permanent Magnet Brushed Direct Current Motor rated for 350W and 24V the selection of motor was done by comparing to one Bull Power Required for running weeder in normal small agriculture farm. Hence as one bull power is equal to 187 W the motor of following rating was selected the benefit of using specified motor is as it is cheap and comparatively powerful readily available in market.

2) Design of Project



- 3) *Project Design Idea:* In the above figure we can get idea of actual representation of project in which we can see the complete system will work and how all the individual blocks as discussed above are combined to get the desired output. In the figure shown above we can see that solar panel is placed above near to the handle to serve two purposes first to generate ample amount of energy to drive system as well as to create a housing for other environment sensitive or delicate system components. The weeder idea is taken from traditional type hand-controlled weeder which uses users' weight for maintaining weeder blades inside ground it also shows the arrangement of handle, the main circuitry box drive motor and main drive wheel.
- a) *Construction:* One electrical dc motor is connected to the wheels of the machine with the help of chain sprocket mechanism. These mechanisms transmit the power from the motor to the shafts of the wheels and weeder blades. In this machine ferro-type blades are used. This shape of blades mainly used for weeding hard soils such as dry lands. These fixed blades are attached to the rear end at the roots of weeds. The high torque motors are connected to the two batteries in series

A. Motor & Speed Controller

Low carbon vehicle with renewable energy technology was a very popular research topic in the past decade. Many researchers believe full EV will be the best solution of tight oil supply in the near future. An EV is normally driven by an electric motor, which is powered by an energy storage unit (ESU), such as battery, supercapacitor or hydrogen fuel cell. However, no matter what kind of ESU is chosen, it supplies the same electric power source. Due to this limited on-board power source, EVs provide a shorter driving range compared with traditional internal combustion engine (ICE) vehicles. Different kinds of motors have been used on EVs, the most commonly used one is the DC motor. DC motor has a constant torque below the base speed and a constant power beyond the base speed.

- 1) *Motoring Mode:* In this mode of operation, the load torque and hence the motor current I_a is positive, therefore the back emf i.e. $K\omega$ is always less than the motor's armature voltage by an amount equal to $I_a R_a$. Therefore, in order to rotate the motor at the desired speed, the duty ratio adjusts itself so as to always keep the armature voltage greater than the back emf by an amount $I_a R_a$ and hence the converter works in the boost operation at all the time while motoring.
- 2) *Regenerative Mode:* During downhill motion, due to the slope, a negative load torque acts on the motor. Due to the negative load torque, the motor current gets negative and hence the motor's back emf voltage rises by an amount equal to $I_a R_a$ than the armature voltage. Now if we consider that the ω is the speed of the motor and we want to keep the motor rotating during at a constant speed during motoring as well as regeneration, then ω is given by:

Motoring (positive load torque T_l):

$$\omega = \frac{V_{2m} - I_a R_a}{K}$$

During Regeneration (negative load torque- T_l):

$$\omega = \frac{V_{2reg} - I_a R_a}{K}$$

From the above equations we see that if we want to keep the speed constant during both the modes, then we have

$$V_{2reg} = V_{2m} - 2I_a R_a$$

Clearly, we see that the armature voltage should decrease during regeneration so as to keep the speed constant. Therefore, the duty ratio of the boost switch decreases and it moves into the buck operating region and the motor acts as a generator to recharge the battery. Thus, the switching between the motoring mode and the regenerative mode depends on the magnitude of the negative load torque acting on the motor, battery voltage and the speed of the motor.

B. Advantages & Disadvantages

1) Advantages

- a) The proposed project is ecofriendly as it works on renewable electric source with zero emission's compared to traditional IC engines.
- b) The running cost is zero because its source is renewable energy which is freely available.
- c) Lower maintenance cost as it has simpler design and does not acquire any IC engine which requires regular maintenance.
- d) Design is light weight and compact compared to traditional systems.
- e) It is comparatively cheap

2) Disadvantages

- a) It requires time to charge hence it cannot be utilized for longer continuous work cycle.
- b) The power of machine is limited due motor capacity and battery size.

II. CONCLUSION

The project main purpose was to enhance the performance of traditional weeder by making it run on renewable energy which will also help to reduce pollution caused by IC engine operated weeders also the challenge was to keep it economical and comparatively cheap, by designing & Fabrication of this project as a solution to discussed problem we have achieved certain conclusions:

- A. The Weeder is designed to operate on the renewable solar energy which is free of cost and also nonpolluting hence the fuel consumption & other maintenance cost was nullified compared to traditional weeders.
- B. The system is self-sustainable self-powered and designed as per standards hence it can be utilized universally.
- C. The project as a solution to the above discussed problem is comparatively cheap and more feasible as compared to the traditional available in existence.
- D. The Machine is designed using powerful Drive and sufficient battery backup and fast charging for long and continuous work cycles. Hence it is capable of giving desired output to complete the task.

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