

Solar Powered Seed Sowing Machine

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Abstract

Agriculture Sector is the backbone of Indian Economy. There is a need for improvement in agriculture sector, which can be achieved by using advanced technological methods for farming processes like digging, sowing and irrigation etc. Mechanization reduces labour cost and improves the overall productivity without affecting the quality of soil.

This paper represents a machine which can carry out various farming activities simultaneously. Air and Noise Pollution are caused by the combustion of fossil fuels in IC Engines and External Combustion Engines. To negate these problems, this machine uses Solar Energy as an eco-friendly energy resource. Solar Panel is used to convert solar energy into electrical energy and a DC Motor converts this electrical energy into mechanical energy to rotate a cutter for digging operation. Seed Hopper and Water Tank are used for seed sowing and irrigation operations respectively. This machine maintains seed to seed spacing and row to row spacing. It also decreases the cost of sowing the seeds and requirement of labour.

Keywords: Cutter; DC Motor; Mechanization; Seed Hopper; Solar Energy; Water Tank

Introduction

At present many countries have shortage of skilled labour in agriculture sector, which affects the growth rate of the developing countries including India which hugely depends on agriculture sector. As the population of India is rising, demand of food is also escalating which leads to higher crop production per hectare. So, to fix these problems farmers should use latest technological advancements for the various agricultural practices like digging, sowing, irrigation etc., which are more efficient and less time consuming. The main work of sowing operation is to sow seeds at required depth with specific spacing between the two sowed seeds. This can be achieved with the help of seed sowing machine which will dig the furrow and sow the seeds. After the seeds being placed in the furrow land, it will cover the sowed seeds with soil and sprinkle water. Seed sowing machine saves time and labour requirement, thus saving a lot of money along with the assurance of proper seed broadcasting.

Literature Survey

- 1) Mahesh R. Pundkar. et.al High precision pneumatic planters have been developed for many varieties of crops,

for a wide range of seed sizes, resulting to uniform seeds distribution along the travel path, in seed spacing. The basic function of sowing operation is to sow the seed and fertilizer in rows at required depth and to maintain the distance between the seeds and provide proper compaction over the seed [1]

- 2) Swetha S. et.al In this machine solar panel is used to capture solar energy and then it is converted into electrical energy which in turn is used to charge 12V battery, which then gives the necessary power to a shunt wound DC motor. This power is then transmitted to the DC motor to drive the wheels. And to further reduction of labor dependency, IR sensors are used to maneuver robot in the field. Here 4 post sensors are used to define the territory and robot senses the track length and pitch for movement from line to line. [6]
- 3) Kunal A. Dhande. et.al In this work we replace complicated gear system by hall effect sensor for easier and costlier seed sowing and also reduce a need of labour. The Hall Effect sensor convert rotation into distance for which seed sowing at particular distance. Also, there is adjustable system for sowing at different distance. By using this machine, the sowing can be done row by row and distance will maintain. [7]
- 4) Trupti A. Shinde. et.al In seed sowing machine system, they are used battery powered wheels and dc motor inbuilt in these wheels. When the seeds are empty it detects the level of storage seed and indicates the alarm. When any obstacle comes in the in-front of machine or divert path the seed sowing machine can detect this obstacle very easily. In each complete rotation of rotating wheel there is seeds falls from this seed drum and the seed plantation process can take place smoothly as well as without wastage of seeds. The end of system machine reached and it create alarm. [10]

Proposed System

We propose a machine which can carry out various farming activities like digging, sowing and irrigation etc. Figure 1 shows the block diagram of our experimental setup. This is a manually operated machine which is equipped with a four-wheel drive. The seed sowing machine is developed at a very low cost. It is cheap and easily affordable by rural farmers. It is maintenance free and various adjustments can be made with ease for continuous operation.

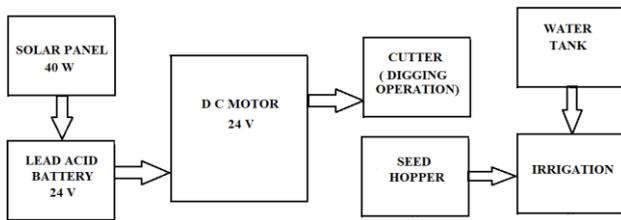


Figure 1: Block Diagram

Hardware

The machine consists of the following components:

- 1) **Solar Panel**- Solar Panel provides renewable and eco-friendly source of energy. It is made up from Photovoltaic(PV) cells. It absorbs sunlight and convert this solar energy into electrical energy.

Specifications-

Rated Power- 40W

Dimension- 470mm x 350mm x 25mm

Cost- INR 750- 900

- 2) **Lead Acid Battery**- It consists electrochemical cells which convert stored chemical energy into electrical energy. Each cell contains a positive terminal and a negative terminal. Electrolyte is responsible for ions mobilization between electrodes and terminals. These ions mobilization allow current to stream out of the battery to perform work.

Specifications-

Rated Voltage- 24V

Capacity- 7.5 Amp Hour

Cost- INR 700- 800

- 3) **D C Motor**- According to Ampere's Law, a wire which carries an electric current produces a magnetic field around it. Following this law, DC Motor creates the mechanical work from electrical energy.

Specifications-

Rated Voltage- 24V

Speed- 1800rpm

Cost- INR 1700- 1900

- 4) **Chassis**- A chassis is a skeleton of the fabricated object, which supports the object in its construction and use.

Specifications-

Material- Mild Steel (Hollow Pipes)

Dimensions- 450mm x 915mm x 450mm

Weight- 20-25 kg

Cost- INR 1500- 2000

- 5) **Seed Hopper**- The Seed Hopper consists of a seed drum made up of two frustums. The small ends of frustums are connected with plastic cylinders. The large ends of frustums are connected to each other and three holes are created on the larger circumference of the hopper. Seeds are inserted in the frustums with the help of capped openings on the face of frustum. Hopper will rotate about its central axis. Seed spacing will be maintained by the holes which are created on the circumference with equal distance.

Specifications-

Seed Spacing- 24mm

Diameter- 23mm

Cost- INR 100- 200

- 6) **Cutter**- A cutting tool or a cutter is any tool which contains sharp teeth on its circumference. Due to fast rotation of cutter, it's teeth will remove material from the surface of the work piece by means of shear deformation.

Specifications-

Cutter Diameter- 220mm

Shaft Diameter- 20mm

Number of Teeth- 8

Cost- INR 400- 500

- 7) **Belt- Pulley System**- A belt and pulley system contain two or more pulleys in common to a belt. This allows for mechanical power, torque, and speed to be transmitted across shafts which contain the pulleys. If the pulleys are of different diameters then a mechanical advantage is produced.

Specification-

Cost- INR 400- 500

- 8) **Adjuster**- It is used to direct the soil from side to the center of the furrow created by the cutter. Adjustment of soil is to be done after seed is sown by the seed hopper. Hence, adjuster needs to perform its function after the complete operation of seed hopper. Seeds must be covered by the soil before irrigation process. After covering seeds with the soil, water is to be sprinkled.

Specification-

Cost- INR 100- 200

- 9) **Water Tank- Tap Arrangement**- For irrigation purpose tank-tap arrangement is used. Water is to be sprinkled on the field after seeds are sowed by the Hopper and covered by soil with the help of the adjuster. A thick plastic sheet is mounted on the chassis which is used to support water tank and solar panel.

Specification-

Cost- INR 100- 200

Methodology

- 1) In this machine a solar panel is used to consume solar energy and this energy is converted into electrical energy. The electrical energy is stored inside a 24V battery of capacity 7.5 Amp Hour, which then gives the necessary power to a DC motor. This power is then transmitted to the cutter through belt and pulley system.
- 2) Due to the shear deformation created by the cutter's teeth, the farm field will be ploughed to create a furrow for the unsown seeds.
- 3) Seed hopper rotate due to the friction between ground and surface of the hopper. Ground contact generates the torque for rotation. Seeds will be dropped on the ground from the holes due to their own weight.
- 4) The basic objective of sowing operation is to put the seeds in rows at desired depth, to maintain seed to seed spacing and to cover the seeds with soil and provide proper compaction over the seed. The recommended

row to row spacing, seed rate, seed to seed spacing and depth of seed placement can vary from crop to crop and for different agro-climatic conditions to achieve optimum yields. Typical application of seed sowing of Cereals including ground nut, all types of dal's, oil seed crop's etc. [6]

- 5) To put the soil back on the seeds, an adjuster is used which adjust the soil towards the furrow created by the cutter.
- 6) After adjusting the soil, water is sprayed from the pipe for cultivation. Water Tank- Tap arrangement is used for irrigation purpose.
- 7) Tires of the machine are rotated by pulling the machine with the help of man power. Tires need to be rotated for forward movement of the vehicle and rotating the seed Hopper.
- 8) Various fabrication processes involve cutting and welding of mild steel, cutting of solid shaft, cutting and welding used in cutter, clamping of ball bearings, bolting of DC motor, slot making for lateral movement of DC Motor, clamping of batteries and solar panel, wiring and clamping of seed sower and adjuster etc.

Photographs of machine



Figure 2: Experimental Setup- I



Figure 3: Experimental Setup- II

Future Scope

- 1) Introduction of drill in place of cutter can be used as soil erosion equipment.
- 2) Machine can be operated automatically with the help of remote control or navigation sensors.
- 3) Multi-hopper can be attached instead of single hopper for sowing of a large farm.
- 4) Seed Spacing sensors can be used for accurate spacing.

Conclusion

In India about 70% of the population lives in rural areas and their main source of income is dependent on agriculture sector. So, it is important to have special focus on agriculture sector and to apply latest technologies and methods which are more advance and efficient. This will lead to better growth rate of the country. Our machine which operate on solar power when compared to different traditional seed sowing methods, it can be concluded that:

- 1) Sowing rate can be controlled
- 2) Seed spacing can be achieved
- 3) Less manual power is required
- 4) No pollution is caused
- 5) Economical
- 6) Variety of seeds can be sowed

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